Agilent U2761A USB Modular Function/Arbitrary Waveform Generator

Programmer's Reference

Agilent Technologies

Notices

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This chapter introduces the remote programming basics of the U2761A USB modular function/arbitrary waveform generator. The SCPI programming commands provide the means to control this instrument remotely via a PC.

Introduction to the SCPI Language

SCPI, also known as the Standard Commands for Programmable Instruments, is an ASCII-based instrument command language designed for test and measurement instruments. SCPI defines how you communicate with an instrument from a bus controller.

SCPI commands are based on a hierarchical structure, similar to the file systems used by many bus controllers. This hierarchical structure is also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus forming subsystems. You must specify the complete path to execute the individual lower-level commands. A portion of the CALibration subsystem is shown below to illustrate the tree system:

```
CALibration:
      SECure:
          STATe {OFF|ON|RESET}, <code>
          STATe?
CALibration:
      SECure:
          CODE <new code>
```

`CALibration` is the root keyword of the command, `SECure` is a second-level keyword, and `STATe` and `CODE` are third-level keywords. A colon (**:**) separates a command keyword from a lower-level keyword.

Mnemonic forms

Each keyword has both a long and a short form. A standard notation is used to differentiate the short form keyword from the long form keyword. The long form of the keyword is shown, with the short form portion shown in uppercase characters, and the rest of the keyword shown in lowercase characters. For example, the short form of `CALibration` is `CAL`.

For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form. For example, in the above syntax statement, `CALibration` and `CAL` are both acceptable forms. You can use a mixture of uppercase and lowercase letters. Therefore, `CALIBRATION`, `cal`, and `Cal` are all acceptable. Other forms, such as `CA` and `cali`, are not valid and will generate an error.

SCPI Conventions and Data Formats

Command separators

Using a colon (:)

A colon (:) is used to separate a command keyword from a lower-level keyword. When a colon is inserted between two command mnemonics, the colon moves the path down one level in the present path (for the specified root-level command) of the command tree. You must separate command mnemonics from each other using a colon as shown below:

→ `FUNC:RAMP:SYMM 50`

An error is generated if you do not use the colon in your command string:

→ `FUNC RAMP SYMM 50`

→ `SYST:ERR?`

Typical response:

← `-103,"Invalid separator"`

NOTE

"→" indicates the commands that you send to the U2761A.

"←" indicates the response from the U2761A.

Using a semicolon (;)

A semicolon (;) is used to separate commands within the same subsystem, and can also minimize typing. For example, sending the following command string:

→ `FREQ:STAR 10; STOP 1000`

... is the same as sending the following two commands:

→ `FREQ:STAR 10`

→ `FREQ:STOP 1000`

Use a semicolon and a colon to link commands from different subsystems. For example, in the following command string, an error is generated if you do not use both the semicolon and colon:

```
→ SWE:STAT ON;:TRIG:SOUR EXT
```

Using a comma (,)

If a command requires more than one parameter, you must separate adjacent parameters using a comma as shown in the following example:

```
→ APPL:SIN 5 KHZ, 3.0 VPP, -2.5 V
```

Using whitespace

You must use whitespace characters, [tab], or [space] to separate a parameter from a command keyword. Whitespace characters are generally ignored only in parameter lists.

Using "?" commands

The bus controller may send commands at any time, but a SCPI instrument may only send responses when specifically instructed to do so.

Only query commands (commands that end with a "?") will instruct the instrument to send a response message. Queries return either measured values or internal instrument settings.

For example, the following command sets the output frequency to 5 kHz:

```
→ FREQ 5000
```

You can then query the current range setting by sending:

```
→ FREQ?
```

Typical response:

```
← +5.0000000000000E+03
```

NOTE

If you send two query commands without reading the response from the first, then attempt to read the second response, you may receive some data from the first response followed by the complete second response. To avoid this, do not send a query command without reading the response. When you cannot avoid this situation, send a device clear before sending the second query command. For more information on device clear, refer to "Using device clear" on page 10.

Using " * " commands

Commands starting with a "*" are called common commands. They are required to perform the identical function for all instruments that are compliant with the IEEE-488.2 interface standard.

The IEEE-488.2 standard defines a set of common commands that perform functions such as reset, self-test, and status operations. Common commands always begin with an asterisk (*), are three characters in length, and may include one or more parameters.

Syntax conventions

The following SCPI conventions are used throughout this guide.

Braces "{ }"

Braces "{ }" enclose the parameter choices for a given command string. For example, the syntax statement below shows that you need to select an output function:

```
[SOURce:]FUNCtion[:SHAPe] {SINusoid|SQUare|RAMP|PULSe|DC|USER}
```

The braces are not sent with the command string. A vertical bar "|" separates multiple parameter choices for a given command string.

Triangle brackets "< >"

Triangle brackets "< >" indicate that you must specify a value for the enclosed parameter. For example, the syntax statement below shows the <value> parameter enclosed in triangle brackets:

```
CALibration:VALue <value>
```

The brackets are not sent with the command string. You must specify a value for the parameter:

```
CALibration:VALue 1E+7
```

Square brackets "[ ]"

Some commands and parameters are enclosed in square brackets "[ ]". Items within the square brackets are optional and can be omitted. For example, the syntax statement below shows that SOURce: is optional and can be omitted:

```
[SOURce:]PULSe:PERiod <seconds>
```

```
PULSe:PERiod <seconds>
```

The brackets are not sent with the command string.

Parenthesis "( )"

Parameters within parentheses are used to specify an address list. The notation (@1) specifies address 1. The notation (@1,3) specifies an address list of 1 and 3. For example, an address list of 0 and 1 is specified in the following command:

```
→ CONF:SSI MAST, (@0,1)
```

Syntax diagram conventions

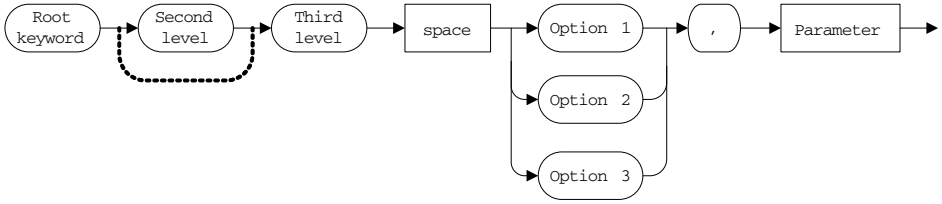

Figure 1-1 Typical syntax diagram

Solid lines represent the recommended path.

Ovals enclose the short form command mnemonics. The command mnemonic must be entered exactly as shown. Ovals are also used to represent discrete parameters and command separators.

Rectangles enclose the parameters required. Refer to "Data types and formats" on page 8 for a complete list of the various data types and formats used throughout this guide. Rectangles are also used to represent white space.

Dotted lines indicate an optional path for bypassing secondary keywords.

Arrows and curved intersections indicate command path direction.

Data types and formats

The SCPI language defines different data formats for use in program messages and response messages. Instruments are flexible listeners and can accept commands and parameters in various formats. However, SCPI instruments are precise talkers. This means that SCPI instruments always respond to a particular query in a predefined, rigid format.

Numeric

Parameters that accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. You can also send engineering unit suffixes with numeric parameters such as `Mhz` or `Khz`. If only specific numeric values are accepted, the instrument will automatically round the input numeric parameters. The following command uses a numeric parameter:

```
[SOURce:]FM:INTernal:FREQuency <frequency>
```

Discrete

Parameters used to program settings that have a limited number of values such as `BUS`, `IMMediate`, and `EXTernal`. Some of these parameters have a short form and a long form just like command keywords. You can mix uppercase and lowercase letters. Query responses will always return the short form in all uppercase letters. The following command uses discrete parameters:

```
[SOURce:]SWEep:SPACing {LINear|LOGarithmic}
```

Boolean

Parameters that represent a single binary condition that is either true or false. For a false condition, the U2761A will accept `OFF` or `0`. For a true condition, the U2761A will accept `ON` or `1`. When you query a boolean setting, the U2761A will always return `0` or `1`. The following command uses boolean parameters:

```
OUTPut[:STATe] {0|OFF|1|ON}
```

String

Parameters that contain virtually any set of ASCII characters. A string must begin and end with matching quotes; either with a single quote or a double quote. You can include the quote delimiter as part of the string by typing it twice without any characters in between. The following command uses a string parameter:

```
CALibration:STRing <quoted string>
```

Address list

An address list must be preceded with the "@" symbol and must be enclosed in parentheses "( )". Use the following syntax to specify the U2761A address list:

```
(@<address>[,<address>])
```

The address list parameter allows you to specify a single address or multiple addresses.

For example, address 1 is specified in the following command:

```
→ CONF:SSI SLAV, (@1)
```

An address list of 1 and 3 is specified in the following command:

```
→ CONF:SSI MAST, (@1,3)
```

NOTE The CONFigure:SSI command is the only U2761A command that uses the address list parameter.

Input message terminators

Program messages sent to a SCPI instrument must terminate with a <newline> character. The IEEE-488 End-Of-Identify (EOI) signal is interpreted as a <newline> character and may also be used to terminate a message in place of the <newline> character. A <carriage return> followed by a <newline> is also accepted. Many programming languages allow you to specify a message terminator character or EOI state to be automatically sent with each bus transaction. Message termination always sets the current path back to the root level.

Using device clear

Device clear is an IEEE-488 low-level bus message that you can use to return the instrument to a responsive state (for example, during a lengthy query).

Different programming languages and IEEE-488 interface cards provide access to this capability through their own unique commands. The status registers, the error queue, and all configuration states are left unchanged when a device clear message is received.

Device clear performs the following actions:

- The instrument's input and output buffers are cleared.
- The instrument is prepared to accept a new command string.

An overlapped command, if any, will be terminated with no "Operation Complete" indication.

SCPI Status System

The status system records various instrument conditions and states in several register groups. Each register group is made up of several low-level registers called Condition register, Event register, and Enable register which control the action of specific bits within the register group.

A *Condition register* continuously monitors the state of the instrument. The bits in the condition register are updated in realtime and the bits are not latched or buffered. This is a read-only register and the bits are not cleared when you read the register.

An *Event register* latches the various events from the changes in the condition register. There is no buffering in this register; while an event bit is set, subsequent events corresponding to that bit are ignored. This is a read-only register. Once a bit is set, it remains set until cleared by a query or clear status (*CLS) command.

An *Enable register* defines which bits in the event register will be reported to the Status Byte register group. You can write to or read from an enable register.

The relationship between various registers in the U2761A SCPI status system is shown in Figure 1-2.

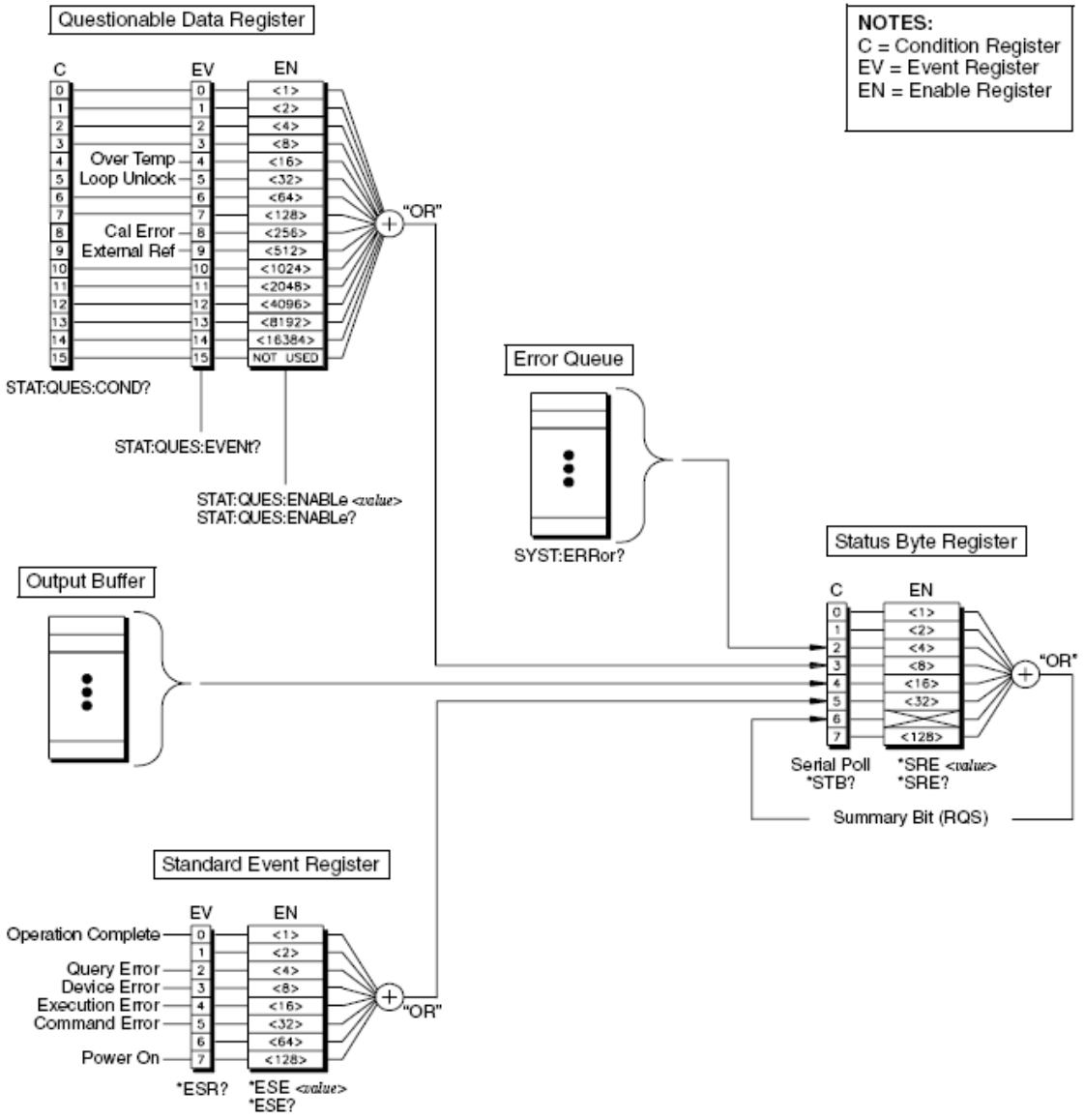

Figure 1-2 Status system diagram

Questionable Data register

The Questionable Data register group provides the information on the quality or integrity of the U2761A. The outputs of the Questionable Data group are logically-ORed into the Questionable summary bit (3) of the Status Byte register.

Bit definitions: Questionable Data register

Bit number	Decimal value	Definition
0 to 3 Not Used	Not Used	0 is returned
4 Over Temperature	16	Internal temperature is over the limit. The U2761A is automatically reset to the default factory settings.
5 Loop Unlocked	32	The internal phase-lock loop is unlocked. Frequency accuracy will be affected
6 to 7 Not Used	Not Used	0 is returned.
8 Calibration Error	256	Error occurred during calibration or the calibration memory is lost
9 External Reference	512	External phase reference is being used
10 to 15 Not Used	Not Used	0 is returned

The STATus:PRESet command will clear all bits in the enable register.

Standard Event register

The Standard Event register group reports the following types of instrument events: power on detected, command syntax errors, command execution errors, device errors (self-test or calibration), query errors, or when an *OPC command is executed. All of these conditions can be reported in the Standard Event summary bit through the enable register. To set the enable register mask, key in a decimal value to the register using the event status enable (*ESE) command.

Bit definitions: Standard Event register

Bit number	Decimal value	Definition
0 Operation Complete	1	All commands prior to and including *OPC have been executed
1 Not Used	Not Used	0 is returned
2 Query Error	4	The U2761A tried to read the output buffer but it was empty. Or, a new command line was received before a previous query has been read. Or, both the input and output buffers are full.
3 Device Error	8	A self-test, calibration, or other device-specific error has occurred
4 Execution Error	16	A command execution error occurred
5 Command Error	32	A command syntax error occurred
6 Not Used	Not Used	0 is returned
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared

The event register in the Standard Event is cleared when:

- you execute the clear status (*CLS) command
- querying the event register using the event status register (*ESR?) command

The Standard Event enable register is cleared when you execute the *ESE 0 command.

NOTE

- When the command, execution, device, and query errors occurred, the related error messages will be generated.
- For a complete listing of the error messages, refer to Chapter 16, "Error Messages" on page 141.

Status Byte register

The Status Byte register group reports the conditions from the other status registers. Clearing an event register from one of the other registers will clear the corresponding bits in the Status Byte condition register. Data that is waiting in the U2761A output buffer is immediately reported on the "Message Available" bit (bit 4).

Bit definitions: Status Byte register

Bit number	Decimal value	Definition
0 to 1 Not Used	Not Used	0 is returned
2 Error Queue	4	There is at least one error message in the error queue
3 Questionable Data Summary	8	One or more bits are set in the Questionable Data register (bits must be enabled in the enable register)
4 Message Available	16	Data is available in the U2761A output buffer
5 Event Status Byte Summary	32	One or more bits are set in the Standard Event register (bits must be enabled in the enable register)
6 Master Status Summary (Request for Service)	64	One or more bits are set in the Status Byte register (bits must be enabled in the enable register). Also used to indicate a request for service.
7 Not Used	Not Used	0 is returned

The Status Byte condition register will be cleared when:

- you execute the clear status (*CLS) command
- you read the event register from one of the other register groups, only the corresponding bits are cleared in the condition register

The Status Byte enable register is cleared when you execute the `*SRE 0` command.

NOTE Refer to Chapter 2, "IEEE-488.2 Common Commands" on page 17 for details of the common IEEE commands mentioned above.

1 Introduction to SCPI

2 IEEE-488.2 Common Commands

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*WAI 29

This section describes the IEEE-488.2 common commands supported by the U2761A.

*CLS

Syntax

```
*CLS
```

This command is used to clear the event registers in all register groups, and also clears the error queue.

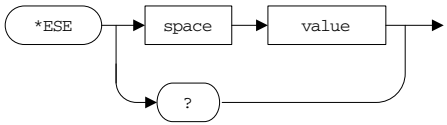
Example

The following command clears the event register bits.

```
*CLS
```

*ESE

Syntax




```
*ESE <value>
```

This command sets the bits in the Standard Event enable register. The selected bits are then reported to bit 5 of the Status Byte register.

```
*ESE?
```

This query reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

For more information on the Standard Event register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Standard Event register are listed in "Standard Event register" on page 14.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
*ESE 16
```

The following query returns the bits enabled in the register.

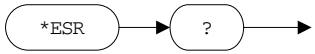
```
*ESE?
```

Typical response:

```
+16
```

*ESR?

Syntax




```
*ESR?
```

This query reads the event register of the Standard Event register group and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register.

Remarks

- Once a bit is set, it will remain set until cleared by a clear status (*CLS) command or queried by this command.
- For more information on the Standard Event register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Standard Event register are listed in "Standard Event register" on page 14.

Example

The following query reads the event register (assumed that bit 4 is set)

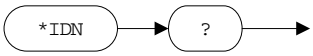
```
*ESR?
```

Typical response:

```
+16
```

*IDN?

Syntax




```
*IDN?
```

This query reads the U2761A identification string which contains four comma-separated fields. The first field is the manufacturer's name, the second field is the model number of the U2761A, the third field is the serial number, and the fourth field is the firmware revision number. This query returns an ASCII string with the following format.

AGILENT TECHNOLOGIES,U2761A,<Serial Number>,m.mm-f.ff-b.bb

m.mm = main firmware revision number
f.ff = I/O processor firmware revision number
b.bb = boot loader firmware revision number

Example

The following query returns the U2761A identification string.

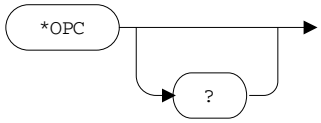
```
*IDN?
```

Typical response:

```
AGILENT TECHNOLOGIES,U2761A,MY12345678,1.00-1.00-1.00
```

*OPC

Syntax




```
*OPC
```

This command sets the “Operation Complete” bit (bit 0) in the Standard Event register when all pending operations have completed. This command is used in the triggered sweep mode to provide a way to poll (interrupt) the PC when the *TRG command has completed.

```
*OPC?
```

This query sends `1` to the output buffer when all pending operations have completed.

Examples

The following command sets the “Operation Complete” bit (bit 0).

```
*OPC
```

The following query waits until the completion of the current command and then sends `1` to the output buffer.

```
*OPC?
```

Typical response:

```
1
```

*RST

Syntax

*RST

This command resets the U2761A to its factory default state, which is the state when the U2761A is powered on. This command will abort a sweep in progress, but does not affect stored Arbitrary waveforms.

NOTE Refer to Chapter 17, "Factory Default Settings" on page 157 for a complete listing of the U2761A default settings.

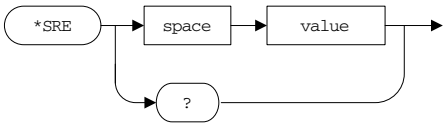
Example

The following command resets the U2761A.

*RST

*SRE

Syntax




```
*SRE <value>
```

This command enables the bits in the Status Byte enable register. The selected enabled bits are summarized in the “Master Summary” bit (bit 6) of the Status Byte register. If any of the selected bit condition changes from 0 to 1, a Service Request is generated.

```
*SRE?
```

This query reads the enable register and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

For more information on the Status Byte register, refer to Chapter 1, “Status system diagram” on page 12. The bit definitions for the Status Byte register are listed in “Status Byte register” on page 15.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
*SRE 16
```

The following query returns the bit enabled in the register.

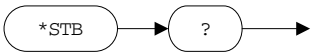
```
*SRE?
```

Typical response:

```
+16
```

*STB?

Syntax




```
*STB?
```

This query reads the summary (condition) of the Status Byte register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. This query is similar to a Serial Poll but it is processed like any other instrument command. This is a read-only register and the bits are not cleared when you read the register.

Remarks

- For more information on the Status Byte register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Status Byte register are listed in "Status Byte register" on page 15.
- This query returns the same results as a Serial Poll but the "Master Summary" bit (bit 6) is not cleared if a Serial Poll has occurred.

Example

The following query reads the condition register (assumed that bits 3 and 4 are set).

```
*STB?
```

Typical response:

```
+24
```

*TRG

Syntax

```
*TRG
```

This command triggers a sweep from the remote interface only if the bus (software) trigger source is currently selected.

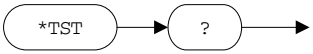
Example

The following command triggers a sweep.

```
*TRG
```

*TST?

Syntax




```
*TST?
```

This query performs a self-test on the U2761A and returns +0 (pass) or +1 (fail). If the test fails, one or more error messages will be generated to provide additional information on the failure.

Example

The following query returns the self-test status.

```
*TST?
```

Typical response:

```
+0
```

*WAI

Syntax

```
*WAI
```

This command sets the U2761A to wait for the completion of all pending operations before executing any additional command over the interface.

Example

The following command sets the U2761A to wait until all pending operations have completed.

```
*WAI
```

3 APPLy Commands

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This section describes the APPLy commands used to program the U2761A over the remote interface. The waveform is output as soon as the APPLy command is executed for each function.

Using the APPLy Command

The APPLy command provides the most straightforward method to program the U2761A over the remote interface. You can select the function, frequency, amplitude, and offset all in one command as shown in the syntax statement below:

```
APPLy:<function> [<frequency> [,<amplitude> [,<offset>] ]]
```

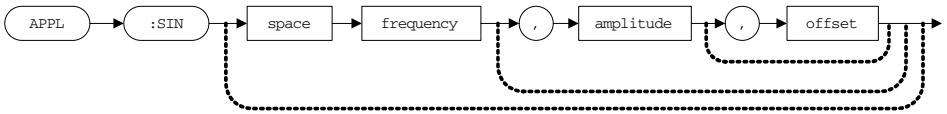
Due to the use of optional parameters in the APPLy commands (enclosed in square brackets), you must specify the frequency to use the amplitude parameter, and you must specify both frequency and amplitude to use the offset parameter. You cannot specify an amplitude or offset without specifying a frequency.

The APPLy command performs additional operations as follows:

- Turns off any modulation or sweep mode currently enabled and places the U2761A in the continuous waveform mode.
- Turns on the output connector (OUTPut[:STATe] command) but does not change the output termination setting (OUTPut:LOAD command).
- For Square waveforms, the command overrides the current duty cycle setting and automatically sets to the default value of 50% ([SOURce:]FUNCtion:SQUare:DCYCle command).
- For Ramp waveforms, the command overrides the current symmetry setting and automatically sets to the default value of 100% ([SOURce:]FUNCtion:RAMP:SYMMetry command).

APPLy:SINusoid

Syntax




```
APPLy:SINusoid [<frequency> [,<amplitude> [,<offset>] ]]
```

This command outputs a Sine wave with the specified frequency, amplitude, and DC offset. The waveform is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	1 µHz to 20 MHz	1 kHz
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
offset	Numeric	• ±2.48 V (Into 50 Ω load) • ±4.96 V (Into open circuit)	0 V

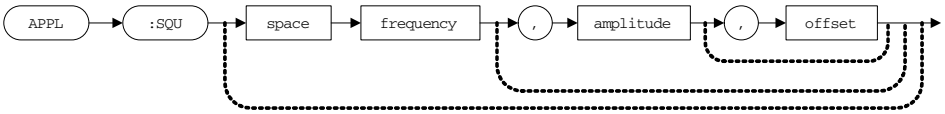
Example

The following command sets the output frequency to 2 kHz, output amplitude to 1 Vpp, and output offset to 0 V.

```
APPL:SIN 2000, 1 VPP, 0
```

APPLy:SQUare

Syntax




```
APPLy:SQUare [<frequency> [,<amplitude> [,<offset>] ]]
```

This command outputs a Square wave with the specified frequency, amplitude, and DC offset. The waveform is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	1 µHz to 20 MHz	1 kHz
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
offset	Numeric	• ±2.48 V (Into 50 Ω load) • ±4.96 V (Into open circuit)	0 V

Remark

This command overrides the current duty cycle setting and automatically sets to the default value of 50%.

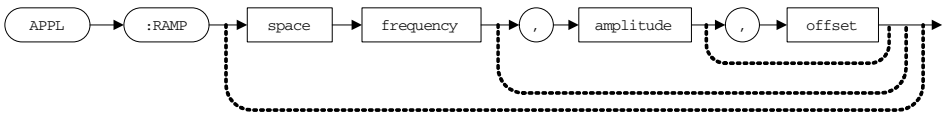
Example

The following command sets the output frequency to 5 kHz, output amplitude to 5 Vpp, and output offset to 0 V.

```
APPL:SQU 5000, 5 VPP, 0
```

APPLy:RAMP

Syntax




```
APPLy:RAMP [<frequency> [,<amplitude> [,<offset>] ]]
```

This command outputs a Ramp wave with the specified frequency, amplitude, and DC offset. The waveform is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	1 µHz to 200 kHz	1 kHz
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
offset	Numeric	• ±2.48 V (Into 50 Ω load) • ±4.96 V (Into open circuit)	0 V

Remark

This command overrides the current symmetry setting and automatically sets to the default value of 100%.

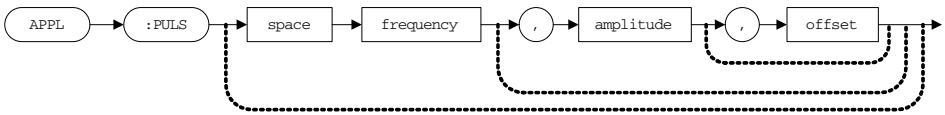
Example

The following command sets the output frequency to 10 kHz, output amplitude to 1 Vpp, and output offset to 0 V.

```
APPL:RAMP 10000, 1 VPP, 0
```

APPLy:PULSe

Syntax




```
APPLy:PULSe [<frequency> [,<amplitude> [,<offset>] ]]
```

This command outputs a Pulse wave with the specified frequency, amplitude, and DC offset. The waveform is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	500 µHz to 5 MHz	1 kHz
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
offset	Numeric	• ±2.48 V (Into 50 Ω load) • ±4.96 V (Into open circuit)	0 V

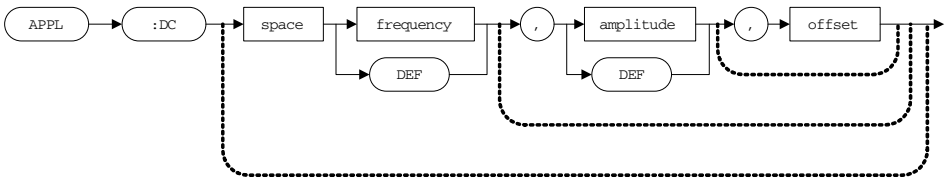
Example

The following command sets the output frequency to 1.5 kHz, output amplitude to 3 Vpp, and output offset to 1 V.

```
APPL:PULS 1500, 3 VPP, 1
```

APPLy:DC

Syntax




```
APPLy:DC [<frequency|DEFault> [,<amplitude>|DEFault>
[,<offset>] ]]
```

This command outputs a DC voltage with the level specified by the offset parameter. The DC voltage is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency|DEFault	Numeric	N/A	DEFault
amplitude|DEFault	Numeric	N/A	DEFault
offset	Numeric	• ±2.5 V (Into 50 Ω load) • ±5 V (Into open circuit)	0 V

Remarks

The frequency and amplitude parameters have no effect for the DC output but you must specify a value or `DEFault`. If you specify a frequency and amplitude, the values are remembered when you change to a different function.

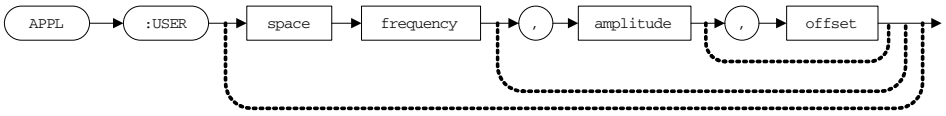
Example

The following command sets the output frequency and amplitude to `DEFault`, and output offset to –2.5 V.

```
APPL:DC DEF, DEF, -2.5
```

APPLy:USER

Syntax




```
APPLy:USER [<frequency> [,<amplitude> [,<offset>] ]]
```

This command outputs a user-defined Arbitrary waveform with the specified frequency, amplitude, and DC offset. The waveform is output as soon as the command is executed.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	1 µHz to 200 kHz	1 kHz
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp
offset	Numeric	• ±2.48 V (Into 50 Ω load) • ±4.96 V (Into open circuit)	0 V

Remarks

The maximum amplitude will be limited if the waveform data points do not span the full range of the output Digital-to-Analog Converter (DAC) from –8191 to +8191. Refer to Chapter 10, "Arbitrary Waveform Commands" on page 103 for more information on downloading Arbitrary waveforms to memory.

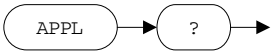
Example

The following command sets the output frequency to 1 kHz, output amplitude to 2 Vpp, and output offset to 0 V.

```
APPL:USER 1000, 2 VPP, 0
```

APPLy?

Syntax



APPLy?

This query returns the U2761A current configuration of the function, frequency, amplitude, and offset in a quoted string (the quotation marks are returned as part of the string).

Example

The following query returns the function, frequency, amplitude, and offset values.

APPL?

Typical response:

"SIN +1.0000000000000E+03,+1.0000000000000E+00,+0.0000000000000E+00"

4
Output Configuration Commands

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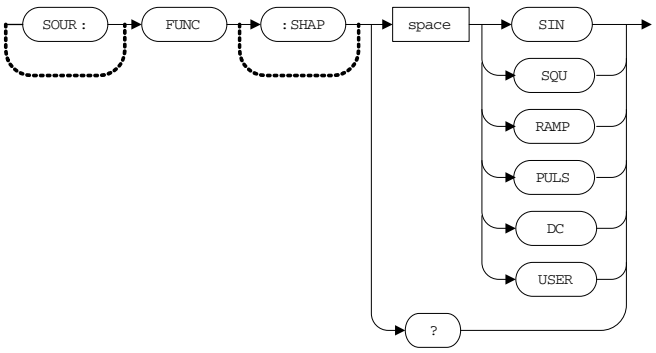
This section describes the low-level commands used to program the U2761A output configuration. These commands allow you to configure the output function, frequency, amplitude and unit, offset voltage, high/low voltage level, duty cycle, symmetry, as well as output state and termination.

[SOURce:]FUNCtion[:SHAPe]

Syntax



`[SOURce:]FUNCtion[:SHAPe] {SINusoid|SQUare|RAMP|PULSe|DC|USER}`

This command sets the output function.

`[SOURce:]FUNCtion[:SHAPe]?`

This query returns the selected output function as `SIN`, `SQU`, `RAMP`, `PULS`, `DC`, or `USER`.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid|SQUare|RAMP|PULSe|DC|USER	SINusoid

Remarks

For the `USER` output function, you will need to download user-defined Arbitrary waveform data into the U2761A volatile memory. Refer to Chapter 10, "Arbitrary Waveform Commands" on page 103 for more information on downloading Arbitrary waveforms to memory.

Examples

The following command sets the output function to Square.

```
FUNC SQU
```

The following query returns the output function.

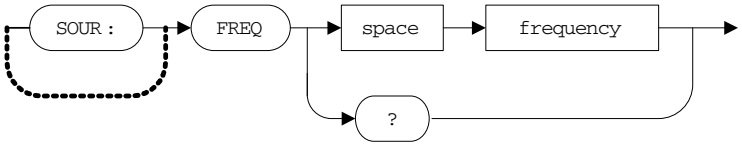
```
FUNC?
```

Typical response:

```
SQU
```

[SOURce:]FREQuency

Syntax




```
[SOURce:]FREQuency <frequency>
```

This command sets the output frequency.

```
[SOURce:]FREQuency?
```

This query returns the frequency setting in Hz for the currently selected function.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	• 1 µHz to 20 MHz (for sine and square) • 1 µHz to 200 kHz (for ramp and arbitrary) • 500 µHz to 5 MHz (for pulse)	1 kHz

Examples

The following command sets the output frequency to 2 kHz.

```
FREQ 2000
```

The following query returns the output frequency setting.

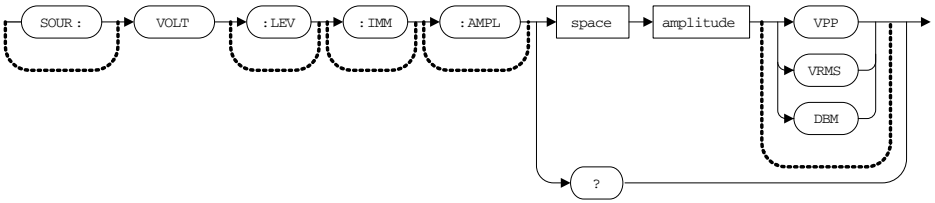
```
FREQ?
```

Typical response:

```
+2.0000000000000E+03
```

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]

Syntax




```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]
<amplitude> [VPP|VRMS|DBM]
```

This command sets the output amplitude with optional unit.

```
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]?
```

This query returns the output amplitude for the currently selected function and unit. Values are always returned in the units set by the most recent [SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT command.

Parameter

Item	Type	Range of values	Default value
amplitude	Numeric	• 40 mVpp to 5 Vpp (Into 50 Ω load) • 80 mVpp to 10 Vpp (Into open circuit)	1 Vpp

Remarks

The RMS and dBm values can be computed as follows:

$$Vrms = Vpeak / Crest\ factor$$

$$dBm = 10 \times log_{10}(P / 0.001), \quad \text{where } P = Vrms^2 / R_{Load}$$ [1]

[1] For the load resistance values, refer to "OUTPut:LOAD" on page 54.

Examples

The following command sets the output amplitude to 5 Vpp.

```
VOLT 5 VPP
```

The following query returns the output amplitude.

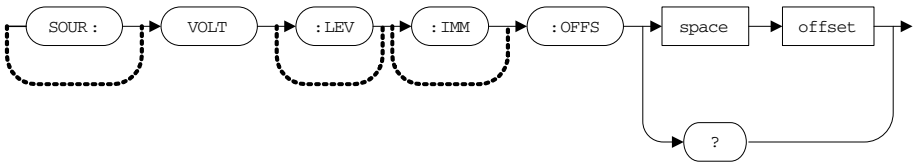
```
VOLT?
```

Typical response:

```
+5.0000000000000E+00
```

[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet

Syntax



`[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet <offset>`

This command sets the offset voltage.

`[SOURce:]VOLTage[:LEVel][:IMMediate]:OFFSet?`

This query returns the offset voltage for the currently selected function.

Parameter

Item	Type	Range of values	Default value
offset	Numeric	• ±2.48 V (Into 50 Ω load)[1] • ±4.96 V (Into open circuit)[1]	0 V

[1] For the DC function, the range of values are ±2.5 V (into 50 Ω load) and ±5 V (into open circuit).

Examples

The following command sets the offset voltage to 1 V.

```
VOLT:OFFS 1
```

The following query returns the offset voltage.

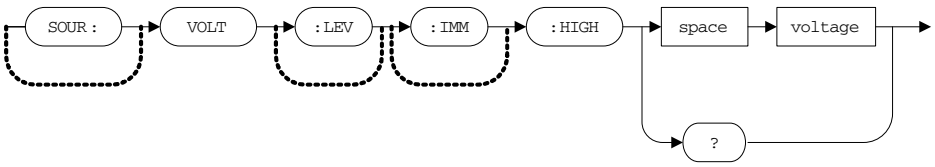
```
VOLT:OFFS?
```

Typical response:

```
+1.0000000000000E+00
```

[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH

Syntax




```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH <voltage>
```

This command sets the high voltage level.

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:HIGH?
```

This query returns the high voltage level for the currently selected function.

Parameter

Item	Type	Range of values	Default value
voltage	Numeric	• –2.46 V to 2.5 V (Into 50 Ω load) • –4.92 V to 5 V (Into open circuit)	0.5 V

Examples

The following command sets the high voltage level to 2 V.

```
VOLT:HIGH 2
```

The following query returns the high voltage level.

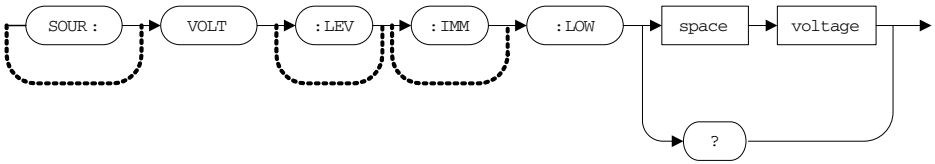
```
VOLT:HIGH?
```

Typical response:

```
+2.0000000000000E+00
```

[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW

Syntax




```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW <voltage>
```

This command sets the low voltage level.

```
[SOURce:]VOLTage[:LEVel][:IMMediate]:LOW?
```

This query returns the low voltage level for the currently selected function.

Parameter

Item	Type	Range of values	Default value
voltage	Numeric	• –2.5 V to 2.46 V (Into 50 Ω load) • –5 V to 4.92 V (Into open circuit)	–0.5 V

Examples

The following command sets the low voltage level to –2 V.

```
VOLT:LOW -2
```

The following query returns the low voltage level.

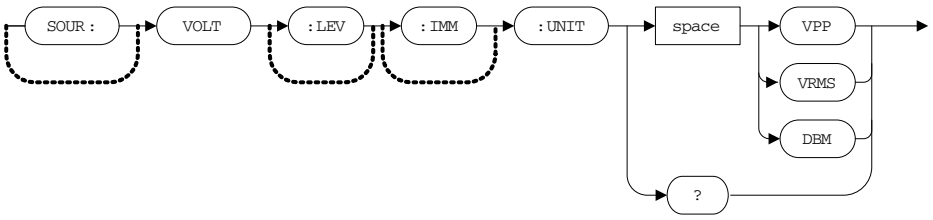
```
VOLT:LOW?
```

Typical response:

```
-2.0000000000000E+00
```

[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT

Syntax



`[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT {VPP|VRMS|DBM}`

This command sets the unit for the output amplitude.

`[SOURce:]VOLTage[:LEVel][:IMMediate]:UNIT?`

This query returns the unit for the output amplitude as `VPP`, `VRMS`, or `DBM`.

Parameter

Item	Type	Range of values	Default value
unit	Discrete	VPP|VRMS|DBM	VPP

Examples

The following command sets the unit of the output amplitude to Vpp.

```
VOLT:UNIT VPP
```

The following query returns the output amplitude unit.

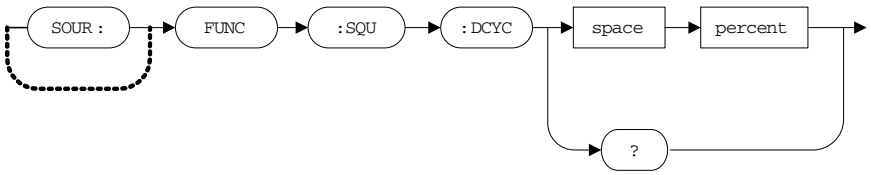
```
VOLT:UNIT?
```

Typical response:

```
VPP
```

[SOURce:]FUNCtion:SQUare:DCYCle

Syntax




```
[SOURce:]FUNCtion:SQUare:DCYCle <percent>
```

This command sets the duty cycle percentage for the Square wave.

```
[SOURce:]FUNCtion:SQUare:DCYCle?
```

This query returns the current duty cycle setting in %.

Parameter

Item	Type	Range of values	Default value
percent	Numeric	• 20% to 80% (for frequency ≤ 10 MHz) • 40% to 60% (for frequency > 10 MHz)	50%

Examples

The following command sets the duty cycle to 80%.

```
FUNC:SQU:DCYC 80
```

The following query returns the duty cycle.

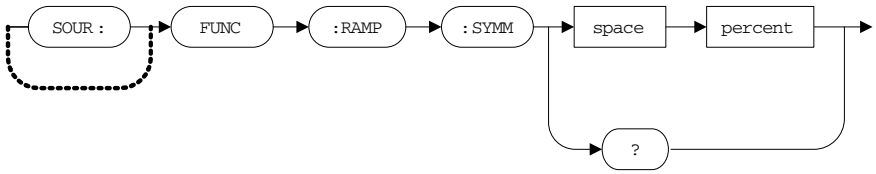
```
FUNC:SQU:DCYC?
```

Typical response:

```
+8.0000000000000E+01
```

[SOURce:]FUNCtion:RAMP:SYMMetry

Syntax




```
[SOURce:]FUNCtion:RAMP:SYMMetry <percent>
```

This command sets the symmetry percentage for the Ramp wave.

```
[SOURce:]FUNCtion:RAMP:SYMMetry?
```

This query returns the current symmetry setting in %.

Parameter

Item	Type	Range of values	Default value
percent	Numeric	0% to 100%	100%

NOTE Setting the symmetry to 50% will produce a Triangle wave, and 0% for a Negative Ramp wave.

Examples

The following command sets the symmetry to 50%.

```
FUNC:RAMP:SYMM 50
```

The following query returns the symmetry.

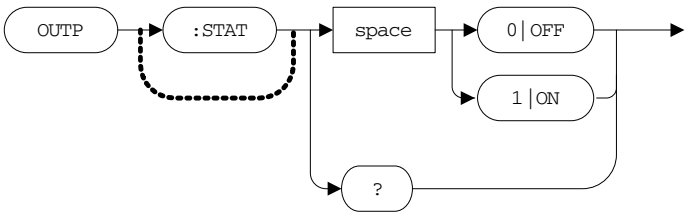
```
FUNC:RAMP:SYMM?
```

Typical response:

```
+5.0000000000000E+01
```

OUTPut[:STATe]

Syntax



`OUTPut[:STATe] {0|OFF|1|ON}`

This command disables or enables the U2761A output.

`OUTPut[:STATe]?`

This query returns the output state as `0` if the output is disabled, or `1` if the output is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Examples

The following command turns on the output.

```
OUTP ON
```

The following query returns the output state.

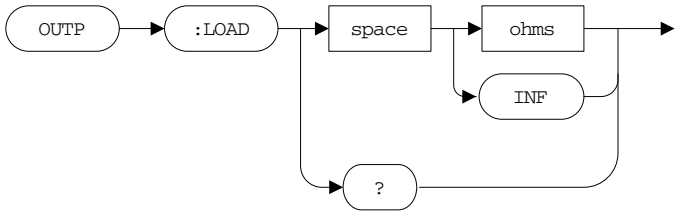
```
OUTP?
```

Typical response:

```
1
```

OUTPut:LOAD

Syntax




```
OUTPut:LOAD {<ohms>|INFinity}
```

This command specifies the desired output termination (the impedance of the load attached to the U2761A output) value. The specified value is used in internal calculations for the amplitude, offset, and high/low level settings. Setting `INFinity` or 9.9E+37 indicates that the output termination is “high impedance”.

```
OUTPut:LOAD?
```

This query returns the current output termination value in Ω or 9.9E+37 (for “high impedance”).

Parameter

Item	Type	Range of values	Default value
load	Numeric	• 1 Ω to 10 kΩ • INFinity (9.9E+37)	50 Ω

Remarks

- The U2761A has a fixed series output impedance of 50 Ω, forming a voltage divider with the load resistance.
- If the actual load impedance is different than the value specified, the calculated amplitude, offset, and high/low levels will be incorrect.

Examples

The following command specifies the output termination value as 2 kΩ.

```
OUTP:LOAD 2000
```

The following query returns the output termination value.

```
OUTP:LOAD?
```

Typical response:

```
+2.0000000000000E+03
```

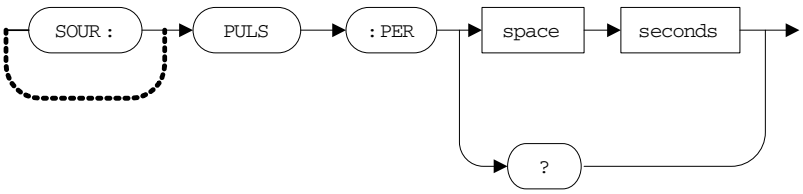
5
Pulse Configuration Commands

[SOURce:]PULSe:PERiod 58
[SOURce:]FUNCtion:PULSe:HOLD 59
[SOURce:]FUNCtion:PULSe:WIDTh 60
[SOURce:]FUNCtion:PULSe:DCYCle 62

This section describes the Pulse configuration commands used to program the U2761A to output a Pulse waveform. These commands allow you to configure the pulse period, pulse hold, pulse width, and pulse duty cycle.

[SOURce:]PULSe:PERiod

Syntax



`[SOURce:]PULSe:PERiod <seconds>`

This command sets the period for the Pulse wave.

`[SOURce:]PULSe:PERiod?`

This query returns the period of the Pulse wave in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	200 ns to 2000 s	1 ms

Examples

The following command sets the period to 1 s.

```
PULS:PER 1
```

The following query returns the pulse period.

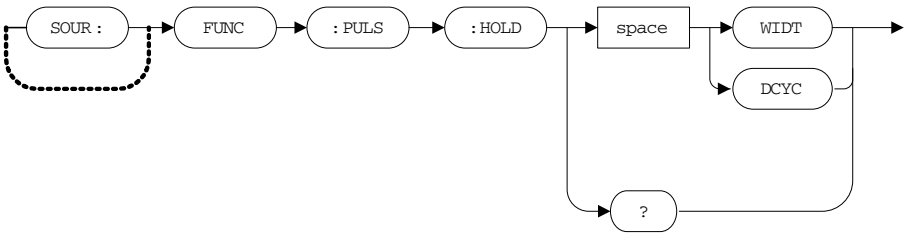
```
PULS:PER?
```

Typical response:

```
+1.0000000000000E+00
```

[SOURce:]FUNCtion:PULSe:HOLD

Syntax



`[SOURce:]FUNCtion:PULSe:HOLD {WIDTh|DCYCle}`

This command sets the U2761A to hold either the pulse width or pulse duty cycle setting constant as the period is varied.

`[SOURce:]FUNCtion:PULSe:HOLD?`

The query returns the pulse hold setting as `WIDT` or `DCYC`.

Parameter

Item	Type	Range of values	Default value
hold	Discrete	WIDTh|DCYCle	WIDTh

Examples

The following command sets the U2761A to hold the pulse width.

```
FUNC:PULS:HOLD WIDT
```

The following query returns the pulse hold setting.

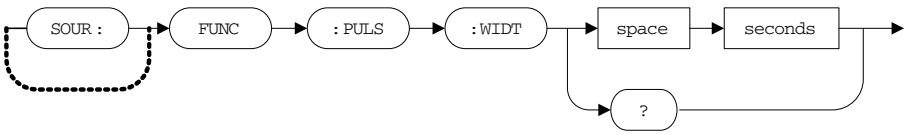
```
FUNC:PULS:HOLD?
```

Typical response:

```
WIDT
```

[SOURce:]FUNCtion:PULSe:WIDTh

Syntax




```
[SOURce:]FUNCtion:PULSe:WIDTh <seconds>
```

This command sets the pulse width in seconds. The pulse width represents the time from the 50% threshold of the pulse rising edge to the 50% threshold of the next falling edge.

```
[SOURce:]FUNCtion:PULSe:WIDTh?
```

This query returns the pulse width in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	40 ns to 1999.99998 s	500 µs

Remarks

The specified pulse width must be less or equal to the difference between the period and the minimum pulse width. The U2761A will adjust the pulse width as necessary to accommodate the specified period. Refer to the *U2761A USB Modular Function/Arbitrary Waveform Generator User's Guide* for more information.

Examples

The following command sets the pulse width to 2 ms.

```
FUNC:PULS:WIDT 0.002
```

The following query returns the pulse width.

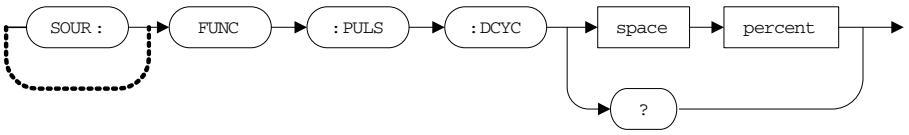
```
FUNC:PULS:WIDT?
```

Typical response:

```
+2.0000000000000E-03
```

[SOURce:]FUNCtion:PULSe:DCYCle

Syntax




```
[SOURce:]FUNCtion:PULSe:DCYCle <percent>
```

This command sets the pulse duty cycle percentage.

```
[SOURce:]FUNCtion:PULSe:DCYCle?
```

This query returns the current pulse duty cycle in %.

Parameter

Item	Type	Range of values	Default value
percent	Numeric	0% to 100%[1]	50%

[1] The pulse duty cycle is limited by minimum pulse width restrictions which prevent you from setting exactly 0% or 100%. Refer to the *U2761A USB Modular Function/Arbitrary Waveform Generator User's Guide* for more information.

Examples

The following command sets the pulse duty cycle to 50%.

```
FUNC:PULS:DCYC 50
```

The following query returns the pulse duty cycle.

```
FUNC:PULS:DCYC?
```

Typical response:

```
+5.0000000000000E+01
```

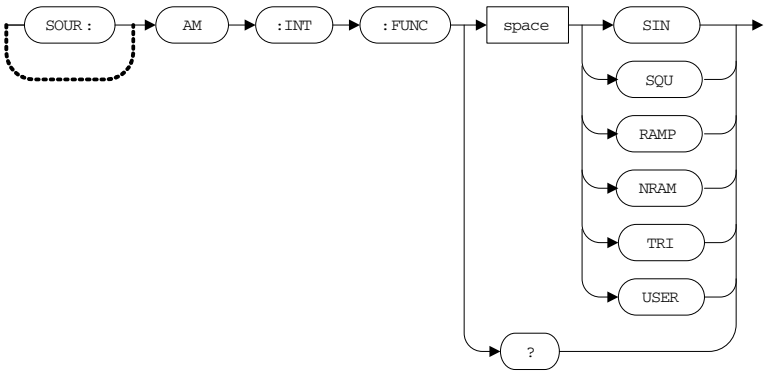
6 Modulation Commands

[SOURce:]AM:INTernal:FUNCtion 64
[SOURce:]AM:INTernal:FREQuency 66
[SOURce:]AM:DEPTh 67
[SOURce:]AM:STATe 68
[SOURce:]FM:INTernal:FUNCtion 69
[SOURce:]FM:INTernal:FREQuency 71
[SOURce:]FM:DEViation 72
[SOURce:]FM:STATe 73
[SOURce:]PM:INTernal:FUNCtion 74
[SOURce:]PM:INTernal:FREQuency 76
[SOURce:]PM:DEViation 77
[SOURce:]PM:STATe 78

This section describes the Modulation commands used to generate modulations of the U2761A. These commands allow you to configure the modulating waveform, frequency, and modulation state for each modulation type, as well as the amplitude modulation depth and frequency/phase deviation.

[SOURce:]AM:INTernal:FUNCtion

Syntax



`[SOURce:]AM:INTernal:FUNCtion {SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}`

This command sets the modulating waveform of the amplitude modulation. The available modulating waveform types consist of sinusoid, square, ramp, negative ramp, triangle, and user-defined.

`[SOURce:]AM:INTernal:FUNCtion?`

This query returns the selected modulating waveform as `SIN`, `SQU`, `RAMP`, `NRAM`, `TRI`, or `USER`.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid | SQUare | RAMP | NRAMp | TRIangle | USER	SINusoid

Examples

The following command sets the modulating waveform to Sine.

```
AM:INT:FUNC SIN
```

The following query returns the modulating waveform.

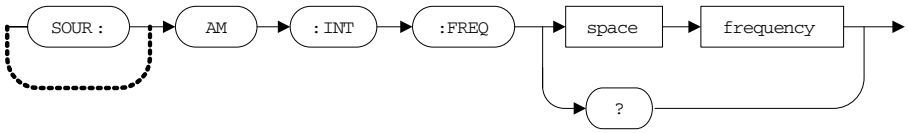
```
AM:INT:FUNC?
```

Typical response:

```
SIN
```

[SOURce:]AM:INTernal:FREQuency

Syntax



`[SOURce:]AM:INTernal:FREQuency <frequency>`

This command sets the frequency of the modulating waveform.

`[SOURce:]AM:INTernal:FREQuency?`

This query returns the modulating frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	2 mHz to 20 kHz	100 Hz

Examples

The following command sets the modulating frequency to 500 Hz.

```
AM:INT:FREQ 500
```

The following query returns the modulating frequency.

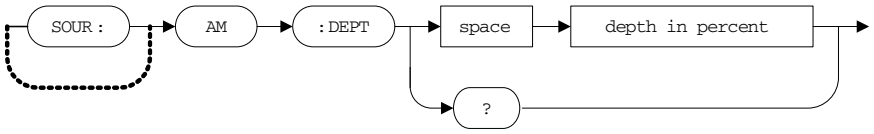
```
AM:INT:FREQ?
```

Typical response:

```
+5.0000000000000E+02
```

[SOURce:]AM:DEPTh

Syntax




```
[SOURce:]AM:DEPTh <depth in percent>
```

This command sets the amplitude modulation depth in %. The modulation depth represents the extent of the amplitude variation.

```
[SOURce:]AM:DEPTh?
```

This query returns the modulation depth in %.

Parameter

Item	Type	Range of values	Default value
depth	Numeric	0% to 100%	100%

Remarks

At 0% depth, the output amplitude is half of the selected value. At 100% depth, the output amplitude equals the selected value.

Examples

The following command sets the modulation depth to 50%.

```
AM:DEPT 50
```

The following query returns the modulation depth.

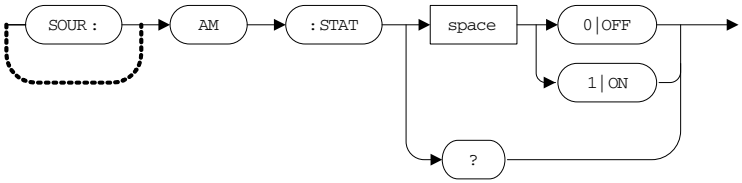
```
AM:DEPT?
```

Typical response:

```
+5.0000000000000E+01
```

[SOURce:]AM:STATe

Syntax



`[SOURce:]AM:STATe {0|OFF|1|ON}`

This command disables or enables the amplitude modulation.

`[SOURce:]AM:STATe?`

This query returns the amplitude modulation state as `0` if the modulation is disabled, or `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the amplitude modulation.

```
AM:STAT ON
```

The following query returns the modulation state.

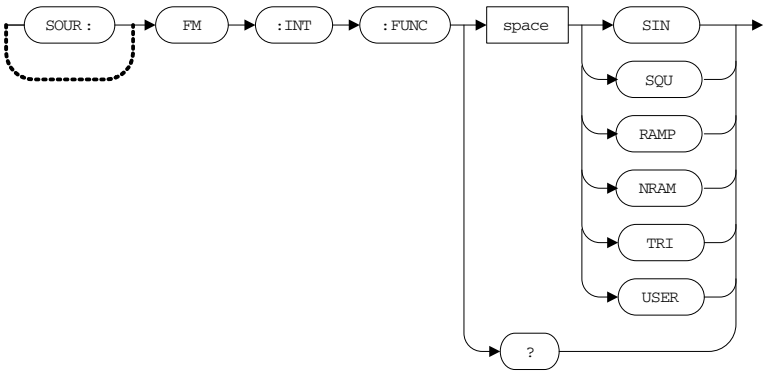
```
AM:STAT?
```

Typical response:

```
1
```

[SOURce:]FM:INTernal:FUNCtion

Syntax



`[SOURce:]FM:INTernal:FUNCtion {SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}`

This command sets the modulating waveform of the frequency modulation. The available modulating waveform types consist of sinusoid, square, ramp, negative ramp, triangle, and user-defined.

`[SOURce:]FM:INTernal:FUNCtion?`

This query returns the selected modulating waveform as `SIN`, `SQU`, `RAMP`, `NRAM`, `TRI`, or `USER`.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER	SINusoid

Examples

The following command sets the modulating waveform to Sine.

```
FM:INT:FUNC SIN
```

The following query returns the modulating waveform.

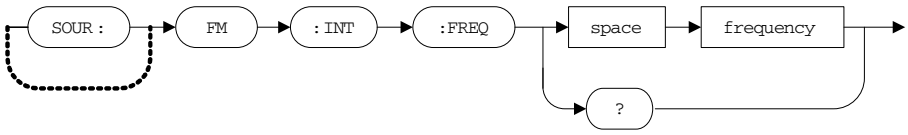
```
FM:INT:FUNC?
```

Typical response:

```
SIN
```

[SOURce:]FM:INTernal:FREQuency

Syntax



`[SOURce:]FM:INTernal:FREQuency <frequency>`

This command sets the frequency of the modulating waveform.

`[SOURce:]FM:INTernal:FREQuency?`

This query returns the modulating frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	2 mHz to 20 kHz	100 Hz

Examples

The following command sets the modulating frequency to 500 Hz.

```
FM:INT:FREQ 500
```

The following query returns the modulating frequency.

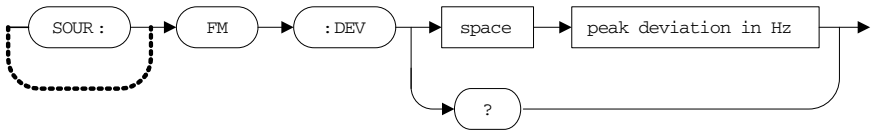
```
FM:INT:FREQ?
```

Typical response:

```
+5.0000000000000E+02
```

[SOURce:]FM:DEViation

Syntax




```
[SOURce:]FM:DEViation <peak deviation in Hz>
```

This command sets the peak frequency deviation in Hz. The deviation setting represents the peak variation in frequency of the modulated waveform from the carrier frequency.

```
[SOURce:]FM:DEViation?
```

This query returns the frequency deviation in Hz.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	1 Hz to 500 kHz[1]	100 Hz

[1] The frequency deviation range is limited to 100 kHz minus 1 µHz for Ramp and Arbitrary waveforms. For more information on the frequency deviation, refer to the *U2761A USB Modular Function/ Arbitrary Waveform Generator User's Guide*.

Examples

The following command sets the frequency deviation to 200 Hz.

```
FM:DEV 200
```

The following query returns the frequency deviation.

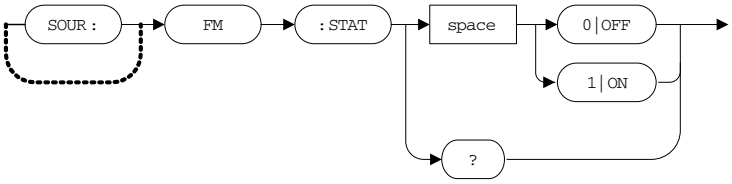
```
FM:DEV?
```

Typical response:

```
+2.0000000000000E+02
```

[SOURce:]FM:STATe

Syntax




```
[SOURce:]FM:STATe {0|OFF|1|ON}
```

This command disables or enables the frequency modulation.

```
[SOURce:]FM:STATe?
```

This query returns the frequency modulation state as `0` if the modulation is disabled, or `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the frequency modulation.

```
FM:STAT ON
```

The following query returns the modulation state.

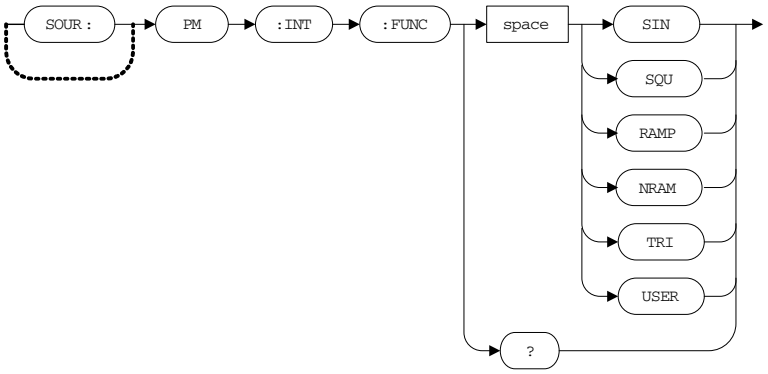
```
FM:STAT?
```

Typical response:

```
1
```

[SOURce:]PM:INTernal:FUNCtion

Syntax



`[SOURce:]PM:INTernal:FUNCtion {SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER}`

This command sets the modulating waveform of the phase modulation. The available modulating waveform types consist of sinusoid, square, ramp, negative ramp, triangle, and user-defined.

`[SOURce:]PM:INTernal:FUNCtion?`

This query returns the selected modulating waveform as `SIN`, `SQU`, `RAMP`, `NRAM`, `TRI`, or `USER`.

Parameter

Item	Type	Range of values	Default value
function	Discrete	SINusoid|SQUare|RAMP|NRAMp|TRIangle|USER	SINusoid

Examples

The following command sets the modulating waveform to Sine.

```
PM:INT:FUNC SIN
```

The following query returns the modulating waveform.

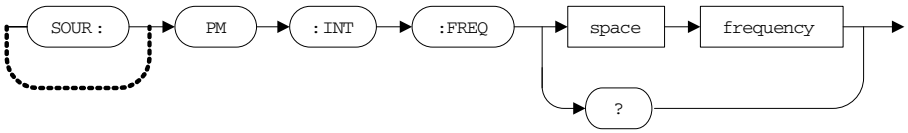
```
PM:INT:FUNC?
```

Typical response:

```
SIN
```

[SOURce:]PM:INTernal:FREQuency

Syntax



`[SOURce:]PM:INTernal:FREQuency <frequency>`

This command sets the frequency of the modulating waveform.

`[SOURce:]PM:INTernal:FREQuency?`

This query returns the modulating frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	2 mHz to 20 kHz	10 Hz

Examples

This command sets the modulating frequency to 500 Hz.

```
PM:INT:FREQ 500
```

The following query returns the modulating frequency.

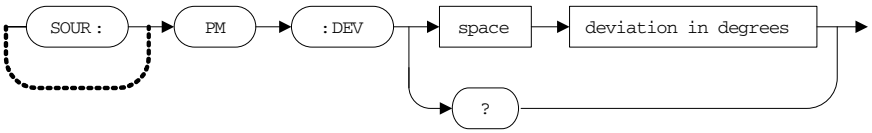
```
PM:INT:FREQ?
```

Typical response:

```
+5.0000000000000E+02
```

[SOURce:]PM:DEViation

Syntax




```
[SOURce:]PM:DEViation <deviation in degrees>
```

This command sets the phase deviation in degrees. The deviation setting represents the peak variation in phase of the modulated waveform from the carrier waveform.

```
[SOURce:]PM:DEViation?
```

This query returns the phase deviation in degrees.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	0 ° to 360 °	180 °

Examples

The following command sets the phase deviation to 10 °.

```
PM:DEV 10
```

The following query returns the phase deviation.

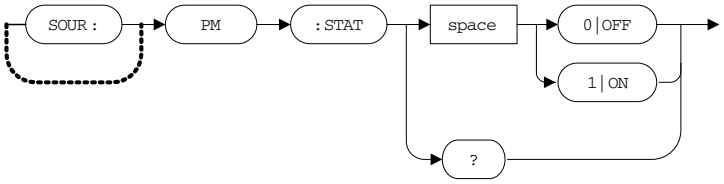
```
PM:DEV?
```

Typical response:

```
+1.0000000000000E+01
```

[SOURce:]PM:STATe

Syntax



`[SOURce:]PM:STATe {0|OFF|1|ON}`

This command disables or enables the phase modulation.

`[SOURce:]PM:STATe?`

This query returns the phase modulation state as `0` if the modulation is disabled, and `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the phase modulation.

```
PM:STAT ON
```

The following query returns the modulation state.

```
PM:STAT?
```

Typical response:

```
1
```

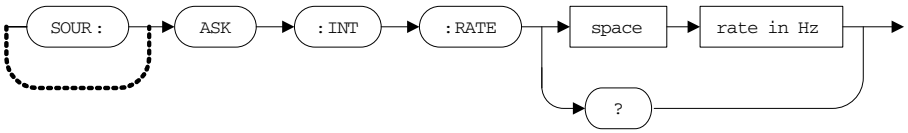
7 Shift Keying Commands

[SOURce:]ASKey:INTernal:RATE 80
[SOURce:]ASKey:STATe 81
[SOURce:]FSKey:FREQuency 82
[SOURce:]FSKey:INTernal:RATE 83
[SOURce:]FSKey:STATe 84
[SOURce:]PSKey:DEViation 85
[SOURce:]PSKey:INTernal:RATE 86
[SOURce:]PSKey:STATe 87

This section describes the Shift keying commands used to perform shift keying modulations of the U2761A. These commands allow you to configure the rate and modulation state for each shift keying modulation type, as well as the frequency-shift keying "hop" frequency and phase-shift keying deviation.

[SOURce:]ASKey:INTernal:RATE

Syntax




```
[SOURce:]ASKey:INTernal:RATE <rate in Hz>
```

This command sets the rate at which the output amplitude “shifts” between two preset amplitudes.

```
[SOURce:]ASKey:INTernal:RATE?
```

This query returns the amplitude-shift keying (ASK) rate in Hz.

Parameter

Item	Type	Range of values	Default value
rate	Numeric	2 mHz to 100 kHz	10 Hz

Remark

The modulating waveform is a Square wave with a 50% duty cycle.

Examples

The following commands sets the ASK rate to 10 Hz.

```
ASK:INT:RATE 10
```

The following query returns the ASK rate.

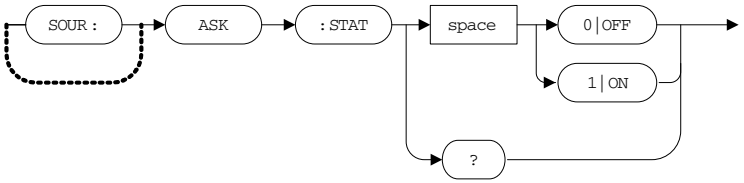
```
ASK:INT:RATE?
```

Typical response:

```
+1.0000000000000E+01
```

[SOURce:]ASKey:STATe

Syntax




```
[SOURce:]ASKey:STATe {0|OFF|1|ON}
```

This command disables or enables the amplitude-shift keying (ASK) modulation.

```
[SOURce:]ASKey:STATe?
```

This query returns the ASK modulation state as `0` if the modulation is disabled, and `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 | OFF | 1 | ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the ASK modulation.

```
ASK:STAT ON
```

The following query returns the modulation state.

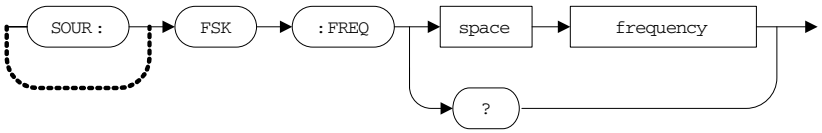
```
ASK:STAT?
```

Typical response:

```
1
```

[SOURce:]FSKey:FREQuency

Syntax




```
[SOURce:]FSKey:FREQuency <frequency>
```

This command sets the frequency-shift keying (FSK) alternate or “hop” frequency.

```
[SOURce:]FSKey:FREQuency?
```

This query returns the “hop” frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	• 1 µHz to 20 MHz (for sine and square) • 1 µHz to 200 kHz (for ramp and arbitrary)	100 Hz

Examples

The following command sets the “hop” frequency to 200 Hz.

```
FSK:FREQ 200
```

The following query returns the “hop” frequency.

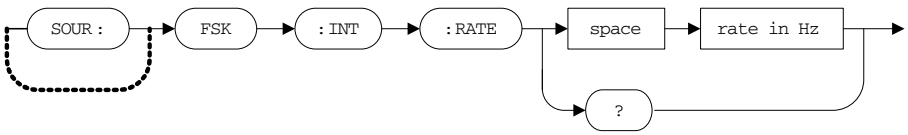
```
FSK:FREQ?
```

Typical response:

```
+2.0000000000000E+02
```

[SOURce:]FSKey:INTernal:RATE

Syntax




```
[SOURce:]FSKey:INTernal:RATE <rate in Hz>
```

The command sets the rate at which the output frequency “shifts” between the carrier frequency and “hop” frequency.

```
[SOURce:]FSKey:INTernal:RATE?
```

This query returns the frequency-shift keying (FSK) rate in Hz.

Parameter

Item	Type	Range of values	Default value
rate	Numeric	2 mHz to 100 kHz	10 Hz

Remark

The modulating waveform is a Square wave with a 50% duty cycle.

Examples

The following command sets the FSK rate to 10 Hz.

```
FSK:INT:RATE 10
```

The following query returns the FSK rate.

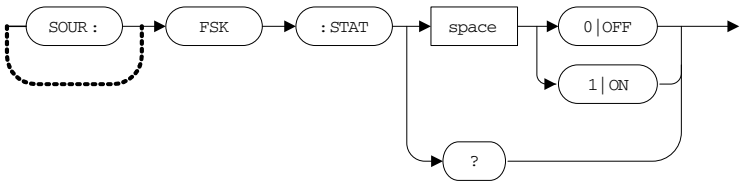
```
FSK:INT:RATE?
```

Typical response:

```
+1.0000000000000E+01
```

[SOURce:]FSKey:STATe

Syntax




```
[SOURce:]FSKey:STATe {0|OFF|1|ON}
```

This command disables or enables the frequency-shift keying (FSK) modulation.

```
[SOURce:]FSKey:STATe?
```

This query returns the FSK modulation state as `0` if the modulation is disabled, and `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the FSK modulation.

```
FSK:STAT ON
```

The following query returns the modulation state.

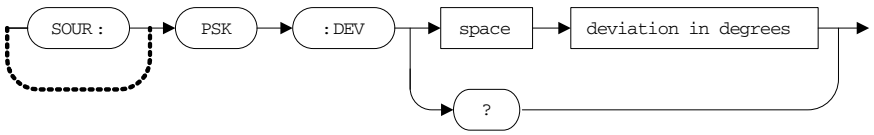
```
FSK:STAT?
```

Typical response:

```
1
```

[SOURce:]PSKey:DEViation

Syntax



`[SOURce:]PSKey:DEViation <deviation in degrees>`

This command sets the phase-shift keying (PSK) deviation in degrees. The deviation setting represents the phase variation of the shifted waveform from the carrier waveform.

`[SOURce:]PSKey:DEViation?`

This query returns the PSK deviation in degrees.

Parameter

Item	Type	Range of values	Default value
deviation	Numeric	0 ° to 360 °	180 °

Examples

The following command sets the PSK deviation to 100 °.

```
PSK:DEV 100
```

The following query returns the PSK deviation.

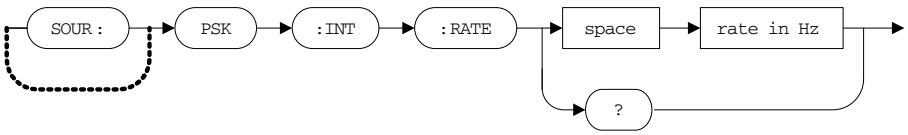
```
PSK:DEV?
```

Typical response:

```
+1.0000000000000E+02
```

[SOURce:]PSKey:INTernal:RATE

Syntax




```
[SOURce:]PSKey:INTernal:RATE <rate in Hz>
```

This command sets the rate at which the output phase “shifts” between two preset phases.

```
[SOURce:]PSKey:INTernal:RATE?
```

This query returns the phase-shift keying (PSK) rate in Hz.

Parameter

Item	Type	Range of values	Default value
rate	Numeric	2 mHz to 100 kHz	10 Hz

Remark

The modulating waveform is a Square wave with a 50% duty cycle.

Examples

The following commands sets the PSK rate to 100 Hz.

```
PSK:INT:RATE 100
```

The following query returns the PSK rate.

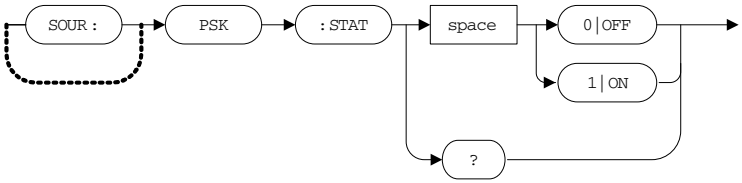
```
PSK:INT:RATE?
```

Typical response:

```
+1.0000000000000E+02
```

[SOURce:]PSKey:STATe

Syntax




```
[SOURce:]PSKey:STATe {0|OFF|1|ON}
```

This command disables or enables the phase-shift keying (PSK) modulation.

```
[SOURce:]PSKey:STATe?
```

This query returns the PSK modulation state as `0` if the modulation is disabled, and `1` if the modulation is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0 | OFF | 1 | ON	0

Remark

The U2761A allows only one modulation mode to be enabled at a time, and does not allow modulation when sweep is enabled.

Examples

The following command enables the PSK modulation.

```
PSK:STAT ON
```

The following query returns the modulation state.

```
PSK:STAT?
```

Typical response:

```
1
```

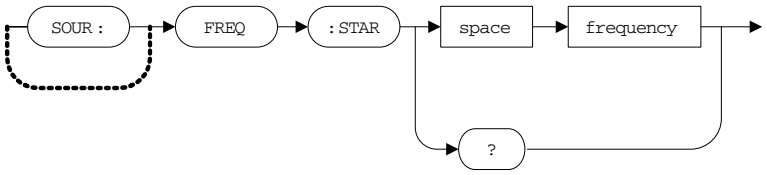
8
Frequency Sweep Commands

[SOURce:]FREQuency:STARt 90
[SOURce:]FREQuency:STOP 91
[SOURce:]SWEep:SPACing 92
[SOURce:]SWEep:TIME 93
[SOURce:]SWEep:STATe 94

This section describes the Frequency sweep commands used to configure the sweep settings of the U2761A. These commands allow you to set the start and stop frequency values, sweep spacing, sweep time, and sweep state.

[SOURce:]FREQuency:STARt

Syntax



`[SOURce:]FREQuency:STARt <frequency>`

This command sets the start frequency.

`[SOURce:]FREQuency:STARt?`

This query returns the start frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	• 1 µHz to 20 MHz (for sine and square) • 1 µHz to 200 kHz (for ramp and arbitrary)	100 Hz

Examples

The following command sets the start frequency to 500 Hz.

```
FREQ:STAR 500
```

The following query returns the start frequency.

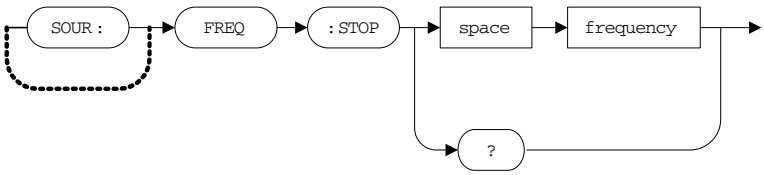
```
FREQ:STAR?
```

Typical response:

```
+5.0000000000000E+02
```

[SOURce:]FREQuency:STOP

Syntax




```
[SOURce:]FREQuency:STOP <frequency>
```

This command sets the stop frequency.

```
[SOURce:]FREQuency:STOP?
```

This query returns the stop frequency in Hz.

Parameter

Item	Type	Range of values	Default value
frequency	Numeric	• 1 µHz to 20 MHz (for sine and square) • 1 µHz to 200 kHz (for ramp and arbitrary)	1 kHz

Examples

The following command sets the stop frequency to 10 kHz.

```
FREQ:STOP 10000
```

The following query returns the stop frequency.

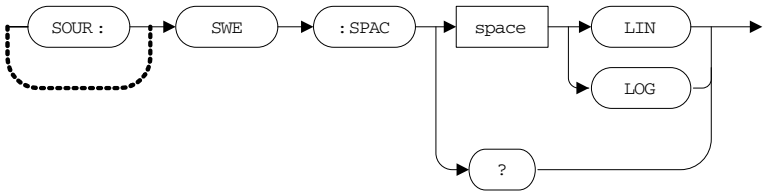
```
FREQ:STOP?
```

Typical response:

```
+1.0000000000000E+04
```

[SOURce:]SWEep:SPACing

Syntax



`[SOURce:]SWEep:SPACing {LINear|LOGarithmic}`

This command sets either the linear or logarithmic spacing for the sweep.

`[SOURce:]SWEep:SPACing?`

This query returns the selected spacing as `LIN` or `LOG`.

Parameter

Item	Type	Range of values	Default value
spacing	Discrete	LINear or LOGarithmic	LINear

Examples

The following command sets the sweep spacing to linear.

```
SWE:SPAC LIN
```

The following query returns the spacing.

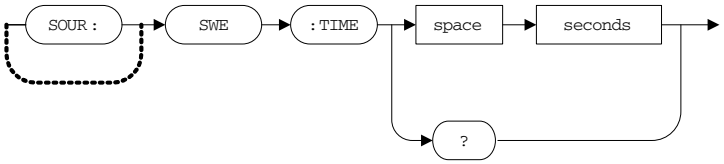
```
SWE:SPAC?
```

Typical response:

```
LIN
```

[SOURce:]SWEep:TIME

Syntax




```
[SOURce:]SWEep:TIME <seconds>
```

This command sets the number of seconds required to sweep from the start frequency to the stop frequency.

```
[SOURce:]SWEep:TIME?
```

This query returns the sweep time in seconds.

Parameter

Item	Type	Range of values	Default value
seconds	Numeric	1 ms to 500 s	1 s

Remark

The number of discrete frequency points in the sweep is automatically calculated by the U2761A and is based on the sweep time you have selected.

Examples

The following command sets the sweep time to 20 s.

```
SWE:TIME 20
```

The following query returns the sweep time.

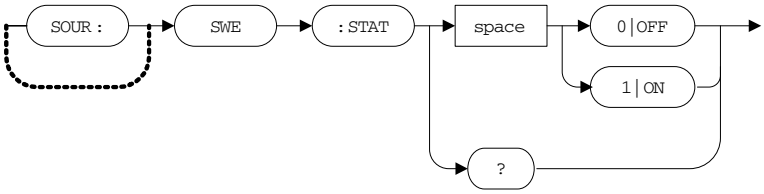
```
SWE:TIME?
```

Typical response:

```
+2.0000000000000E+01
```

[SOURce:]SWEep:STATe

Syntax



`[SOURce:]SWEep:STATe {0|OFF|1|ON}`

This command disables or enables the sweep mode.

`[SOURce:]SWEep:STATe?`

This query returns the sweep state as `0` if the sweep mode is disabled, or `1` if the sweep mode is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Remark

The U2761A does not allow the sweep mode to be enabled at the same time that any modulation mode is enabled.

Examples

The following command enables the sweep mode.

```
SWE:STAT ON
```

The following query returns the sweep state.

```
SWE:STAT?
```

Typical response:

```
1
```

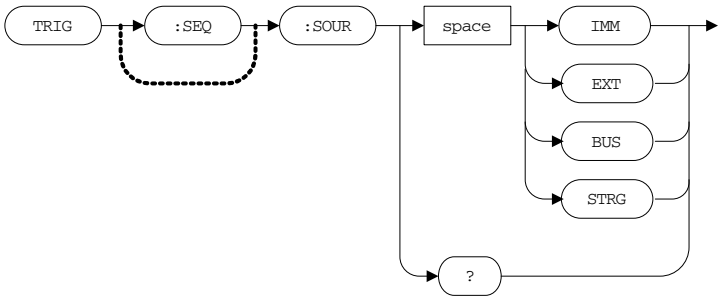
9 Triggering Commands

TRIGger[:SEQuence]:SOURce 96
TRIGger[:SEQuence][:IMMediate] 98
TRIGger[:SEQuence]:SLOPe 99
OUTPut:TRIGger:SLOPe 100
OUTPut:TRIGger[:STATe] 102

This section describes the Triggering commands used to control the trigger functions of the U2761A. These commands allow you to configure the trigger source, trigger slope, and trigger output state, as well as enable you to trigger a sweep.

TRIGger[:SEQuence]:SOURce

Syntax



`TRIGger[:SEQuence]:SOURce {IMMediate|EXTernal|BUS|STRG}`

This command sets the source from which the U2761A will accept a trigger.

- When the Immediate (internal) source is selected, the U2761A outputs continuously when the sweep mode is enabled.
- When the External source is selected, the U2761A accepts a hardware trigger applied to the Trig In connector. The U2761A initiates one sweep each time Trig In receives a TTL pulse with the specified edge.
- When the Bus (software) source is selected, the U2761A initiates one sweep each time a bus trigger command is received. You may send the *TRG command to trigger the U2761A from the remote interface when the Bus source is selected.
- Star trigger (STRG) is the synchronized trigger source from the U2781A modular instrument chassis.

`TRIGger[:SEQuence]:SOURce?`

This query returns the selected trigger source as `IMM`, `EXT`, `BUS`, or `STRG`.

Parameter

Item	Type	Range of values	Default value
source	Discrete	IMMediate | EXTernal | BUS | STRG	IMMediate

Examples

The following command sets the trigger source to Immediate.

```
TRIG:SOUR IMM
```

The following query returns the trigger source.

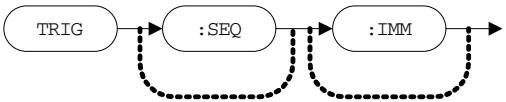
```
TRIG:SOUR?
```

Typical response:

```
IMM
```

TRIGger[:SEQuence][:IMMediate]

Syntax




```
TRIGger[:SEQuence][:IMMediate]
```

This command triggers a sweep from the remote interface. This command can be used with any of the available trigger sources.

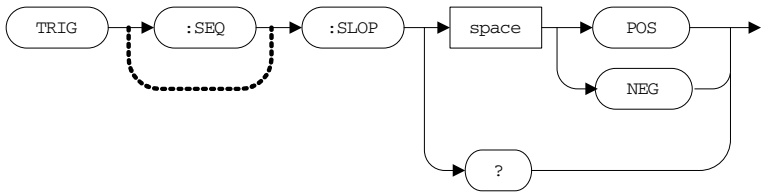
Example

The following command triggers a sweep.

```
TRIG
```

TRIGger[:SEQuence]:SLOPe

Syntax



`TRIGger[:SEQuence]:SLOPe {POSitive|NEGative}`

This command sets the rising or falling edge for the trigger signal on the Trig In connector to start the sweep.

`TRIGger[:SEQuence]:SLOPe?`

This query returns the selected trigger slope as `POS` or `NEG`.

Parameter

Item	Type	Range of values	Default value
slope	Discrete	POSitive|NEGative	POSitive

Examples

The following command sets the trigger slope to Positive.

```
TRIG:SLOP POS
```

The following query returns the trigger slope.

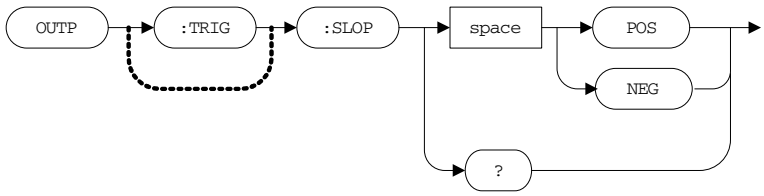
```
TRIG:SLOP?
```

Typical response:

```
POS
```

OUTPut:TRIGger:SLOPe

Syntax




```
OUTPut:TRIGger:SLOPe {POSitive|NEGative}
```

This command sets the rising or falling edge for the “trigger out” signal at the beginning of the sweep. When enabled using the OUTPut:TRIGger[:STATe] command, a TTL-compatible Square waveform with the specified edge is output from the Trig Out connector at the beginning of the sweep.

```
OUTPut:TRIGger:SLOPe?
```

This query returns the selected trigger slope as `POS` or `NEG`.

Parameter

Item	Type	Range of values	Default value
slope	Discrete	POSitive | NEGative	POSitive

Remarks

- When the Immediate (internal) trigger source is selected, the U2761A outputs a Square waveform with a 50% duty cycle from the Trig Out connector at the beginning of the sweep. The period of the waveform is equal to the specified sweep time.
- When the Bus (software) trigger source is selected, the U2761A outputs a pulse from the Trig Out connector at the beginning of each sweep.

Examples

The following command sets the trigger slope to Positive.

```
OUTP:TRIG:SLOP POS
```

The following query returns the trigger slope.

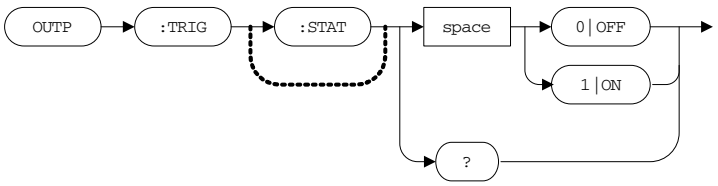
```
OUTP:TRIG:SLOP?
```

Typical response:

```
POS
```

OUTPut:TRIGger[:STATe]

Syntax




```
OUTPut:TRIGger[:STATe] {0|OFF|1|ON}
```

This command disables or enables the “trigger out” signal on the Trig Out connector. When enabled, a TTL-compatible Square waveform with the specified edge is output from the Trig Out connector at the beginning of the sweep.

```
OUTPut:TRIGger[:STATe]?
```

This query returns the trigger output state as `0` if the “trigger out” signal is disabled, or `1` if the signal is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Examples

The following command enables the trigger output.

```
OUTP:TRIG ON
```

The following query returns the trigger output state.

```
OUTP:TRIG?
```

Typical response:

```
1
```

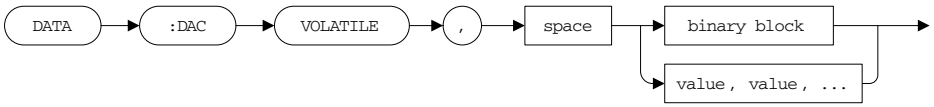
10
Arbitrary Waveform Commands

DATA:DAC VOLATILE 104
FORMat:BORDer 106
DATA:ATTRibute:AVERage? 107
DATA:ATTRibute:CFACtor? 108
DATA:ATTRibute:POINts? 109
DATA:ATTRibute:PTPeak? 110

This section describes the Arbitrary waveform commands used to configure the user-defined Arbitrary waveforms for the U2761A. These commands allow you to download the arbitrary data and configure the byte order format. You may also query the number of points as well as the average, crest factor, and peak-to-peak values of the data points. Use the `FUNC USER` or `APPL:USER` command to output an Arbitrary waveform.

DATA:DAC VOLATILE

Syntax




```
DATA:DAC VOLATILE, {<binary block>|<value>, <value>, . . . }
```

This command downloads the arbitrary data in binary block or decimal integer values from –8191 to +8191 into volatile memory. You can download from 1 point (a DC signal) to 65536 (64K) points per waveform in IEEE-488.2 binary block format or as a list of values. The range of values corresponds to the values available using internal 14-bit Digital-to-Analog Converter (DAC) codes. The U2761A takes the specified number of points and expands them to fill up the waveform memory.

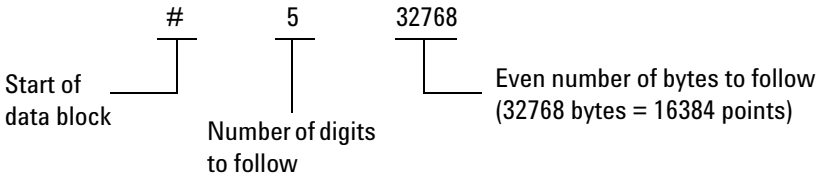
Parameter

Item	Type	Range of values	Default value
value	Numeric	–8191 to +8191	0

Remarks

- The values of –8191 and +8191 correspond to the peak values of the waveform (if the offset is 0 V).
- The maximum amplitude will be limited if the data points do not span the full range of values between ±8191.
- The `DATA:DAC` command overwrites the previous waveform in volatile memory (and no error will be generated).

- In the IEEE-488.2 binary block format, a block header precedes the waveform data. The block header has the following format:



The U2761A represents binary data as 16-bit integers, which are sent as two bytes. Therefore, the total number of bytes is always twice the number of data points in the waveform (and must always be an even number). For example, 32768 bytes are required to download a waveform with 16384 points.

Use the FORMat:BORDer command to select the byte order for binary data. If you specify `FORM:BORD NORM` (default), the most-significant byte (MSB) of each data point is assumed first. If you specify `FORM:BORD SWAP`, the least-significant byte (LSB) of each data point is assumed first.

Examples

The following command downloads seven integer points using the binary block format.

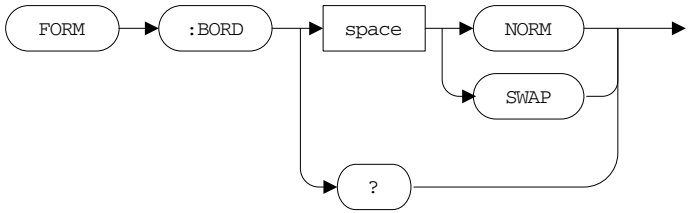
`DATA:DAC VOLATILE, #214` *Binary Data*

The following command downloads four integer points in decimal format.

```
DATA:DAC VOLATILE, -8191, 0, 8191, 0
```

FORMat:BORDer

Syntax




```
FORMat:BORDer {NORMal|SWAPped}
```

This command sets the byte order format for binary block downloads. For the Normal byte order, the most significant byte (MSB) of each data point is assumed first. For the Swapped byte order, the least significant byte (LSB) of each data point is assumed first.

```
FORMat:BORDer?
```

This query returns the selected byte order format as `NORM` or `SWAP`.

Parameter

Item	Type	Range of values	Default value
format	Discrete	NORMal|SWAPped	NORMal

Examples

The following command sets the Normal byte order.

```
FORM:BORD NORM
```

The following query returns the byte order format.

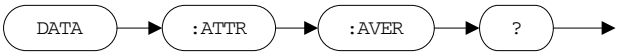
```
FORM:BORD?
```

Typical response:

```
NORM
```

DATA:ATTRibute:AVERage?

Syntax




```
DATA:ATTRibute:AVERage?
```

This query returns the arithmetic average of all data points for the Arbitrary waveform.

Example

The following query returns the average of the data points.

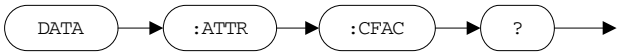
```
DATA:ATTR:AVER?
```

Typical response:

```
+0.0000000000000E+00
```

DATA:ATTRibute:CFACtor?

Syntax




```
DATA:ATTRibute:CFACtor?
```

This query returns the crest factor of all data points for the Arbitrary waveform.

Remarks

Crest factor is the ratio of a signal peak value to its RMS value and will differ according to waveshape. The crest factor can be computed as follows:

Crest factor = Vpeak / Vrms

The typical crest factor values for several common waveforms are stated in the following table:

Waveform	Crest factor
Sine	1.414
Triangle	1.732
Square	1
DC	1

Example

The following query returns the crest factor of the data points. (Assuming that the Arbitrary waveform used has a sine waveshape).

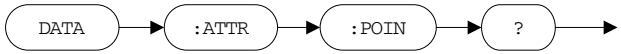
```
DATA:ATTR:CFAC?
```

Typical response:

```
+1.4142140000000E+00
```

DATA:ATTRibute:POINts?

Syntax




```
DATA:ATTRibute:POINts?
```

This query returns the number of points for the Arbitrary waveform from 1 to 65536 points.

Example

The following query returns the points for the Arbitrary waveform.

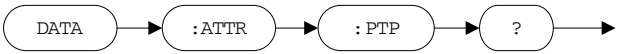
```
DATA:ATTR:POIN?
```

Typical response:

```
+4.0000000000000E+00
```

DATA:ATTRibute:PTPeak?

Syntax




```
DATA:ATTRibute:PTPeak?
```

This query returns the peak-to-peak value of all data points for the Arbitrary waveform from “0” to “16382”, with “16382” indicating full amplitude available.

Example

The following query returns the peak-to-peak value of the data points.

```
DATA:ATTR:PTP?
```

Typical response:

```
+1.6382000000000E+04
```

11 SYSTem Commands

SYSTem:CDEScription? 112
SYSTem:ERRor? 113
SYSTem:VERSion? 114

This section provides the system-related information such as error conditions and chassis identity. This information is not directly related to waveform generation but is an important part of the U2761A system.

SYSTem:CDEScription?

Syntax

```
SYSTem:CDEScription?
```

This query identifies which slot and chassis that the U2761A is plugged into the U2781A modular instrument chassis, and returns the slot and chassis number respectively.

Remarks

- If the U2761A is in standalone mode, then this query would return `+7,+0`.
- Refer to the *U2781A Modular Instrument Chassis User's Guide* for details.

Example

The following query returns the slot and chassis number (assuming that the U2761A is slotted into slot 5 of chassis #12).

```
SYST:CDES?
```

Typical response:

```
+5,+12
```

SYSTem:ERRor?

Syntax

```
SYSTem:ERRor?
```

This query returns the next error number and its corresponding message string from the error queue. The queue is a first-in, first-out (FIFO) buffer that stores errors as they occur. Errors are cleared as you read them.

Remarks

- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **`-350,"Queue overflow"`**.
- If no errors have occurred when you read the error queue, the U2761A responds with `+0,"No error"`.
- The error queue is cleared by the clear status (*CLS) command or when power is cycled. The errors are also cleared when you read the queue.
- Refer to Chapter 16, "Error Messages" on page 141 for the error messages.

Example

The following query reads and clears one error.

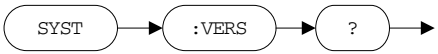
```
SYST:ERR?
```

Typical response:

```
-101,"Invalid character"
```

SYSTem:VERSion?

Syntax




```
SYSTem:VERSion?
```

This query returns the SCPI standard version with which the U2761A is in compliance. The response format is in the form of YYYY.V, where YYYY represents the year of the version and V represents the version number for that year.

Example

The following query returns the SCPI version.

```
SYST:VERS?
```

Typical response:

```
1997.0
```

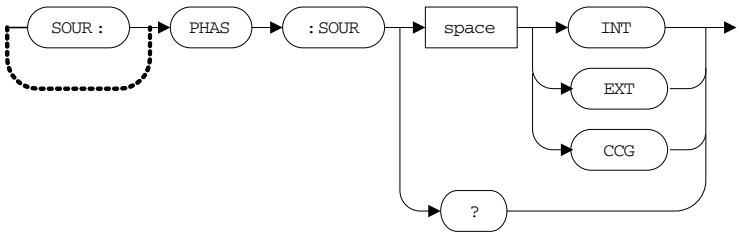
12
Phase-Lock Commands

[SOURce:]PHASe:SOURce 116
[SOURce:]PHASe[:ADJust] 117
UNIT:ANGLe 118
[SOURce:]PHASe:REFerence 119
[SOURce:]PHASe:UNLock:ERRor[:STATe] 120
OUTPut:PHASe[:STATe] 121

This section describes the Phase-lock commands used to configure the phase-lock settings of the U2761A. These commands allow you to set the phase source, phase offset and unit, zero-phase reference point, phase-lock error state, and phase output state.

[SOURce:]PHASe:SOURce

Syntax



`[SOURce:]PHASe:SOURce {INTernal|EXTernal|CCG}`

This command sets the phase source to synchronize the output waveform. Chassis reference clock (CCG) is the synchronized phase source from the U2781A modular instrument chassis.

`[SOURce:]PHASe:SOURce?`

This query returns the selected phase source as `INT`, `EXT`, or `CCG`.

Parameter

Item	Type	Range of values	Default value
source	Discrete	INTernal|EXTernal|CCG	INTernal

Examples

The following command sets the phase source to Internal.

```
PHAS:SOUR INT
```

The following query returns the phase source.

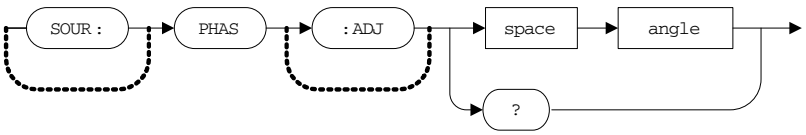
```
PHAS:SOUR?
```

Typical response:

```
INT
```

[SOURce:]PHASe[:ADJust]

Syntax




```
[SOURce:]PHASe[:ADJust] <angle>
```

This command adjusts the phase offset of the output waveform in degrees or radians as specified by the UNIT:ANGLe command.

```
[SOURce:]PHASe[:ADJust]?
```

This query returns the adjusted phase offset in the specified unit.

Parameter

Item	Type	Range of values	Default value
angle	Numeric	• –360 ° to 360 ° (for degrees) • –2 π to 2 π (for radians)	0 °

Examples

The following command sets the phase offset to 180 °.

```
PHAS 180
```

The following query returns the phase offset.

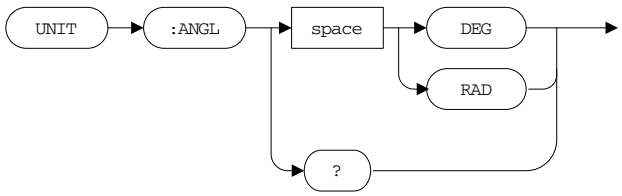
```
PHAS?
```

Typical response:

```
+1.8000000000000E+02
```

UNIT:ANGLe

Syntax



`UNIT:ANGLe {DEGree|RADian}`

This command sets either degrees or radians for the phase offset value.

`UNIT:ANGLe?`

This query returns the selected unit as `DEG` or `RAD`.

Parameter

Item	Type	Range of values	Default value
unit	Discrete	DEGree|RADian	DEGree

Examples

The following command sets the phase offset unit to degrees.

```
UNIT:ANGL DEG
```

The following query returns the phase offset unit.

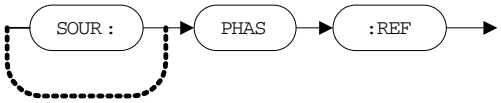
```
UNIT:ANGL?
```

Typical response:

```
DEG
```

[SOURce:]PHASe:REFerence

Syntax




```
[SOURce:]PHASe:REFerence
```

This command immediately sets the zero-phase reference point without changing the output of the U2761A. This command resets the phase offset value returned by the [SOURce:]PHASe[:ADJust] command but does not affect the output waveform.

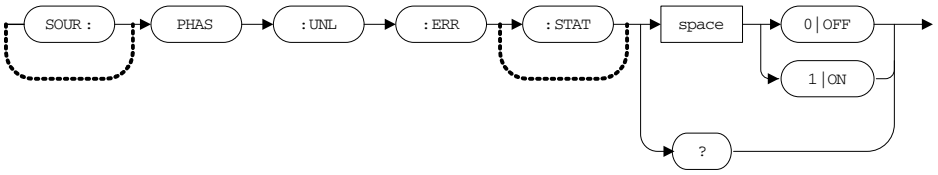
Example

The following command sets the zero-phase reference point.

```
PHAS:REF
```

[SOURce:]PHASe:UNLock:ERRor[:STATe]

Syntax



`[SOURce:]PHASe:UNLock:ERRor[:STATe] {0|OFF|1|ON}`

This command disables or enables the U2761A to generate an error if the phase-lock is ever lost.

`[SOURce:]PHASe:UNLock:ERRor[:STATe]?`

This query returns the phase-lock error state as `0` if disabled, or `1` if enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Examples

The following command enables the phase-lock error state.

```
PHAS:UNL:ERR ON
```

The following query returns the phase-lock error state.

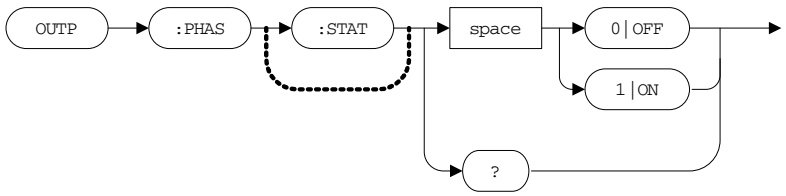
```
PHAS:UNL:ERR?
```

Typical response:

```
1
```

OUTPut:PHASe[:STATe]

Syntax



`OUTPut:PHASe[:STATe] {0|OFF|1|ON}`

This command disables or enables the 10 MHz reference phase output.

`OUTPut:PHASe[:STATe]?`

This query returns the phase output state as `0` if the output is disabled, or `1` if the output is enabled.

Parameter

Item	Type	Range of values	Default value
state	Boolean	0|OFF|1|ON	0

Examples

The following command enables the phase output.

```
OUTP:PHAS ON
```

The following query returns the phase output state.

```
OUTP:PHAS?
```

Typical response:

```
1
```

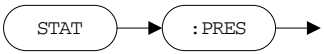
13
Status Reporting Commands

STATus:PRESet 124
STATus:QUEStionable:CONDition? 125
STATus:QUEStionable:ENABle 126
STATus:QUEStionable[:EVENt]? 128

This section describes the Status reporting commands used to determine the operating condition of the U2761A at any time. Refer to Chapter 1, "SCPI Status System" on page 11 for more information on the status registers.

STATus:PRESet

Syntax



`STATus:PRESet`

This command clears all bits in the Questionable Data enable register.

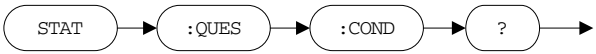
Example

The following command presets the Questionable enable register.

```
STAT:PRES
```

STATus:QUEStionable:CONDition?

Syntax




```
STATus:QUEStionable:CONDition?
```

This query returns the binary-weighted sum of all bits set in the Questionable Data condition register. The condition register is a read-only register, which holds the live (unlatched) questionable status of the instrument. The bits are not cleared when you read the register.

Remarks

For more information on the Questionable condition register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Questionable Data register are listed in "Questionable Data register" on page 13.

Example

The following query reads the Questionable condition register.

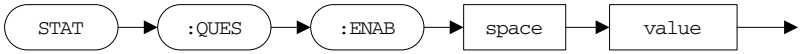
```
STAT:QUES:COND?
```

Typical response:

```
+544
```

STATus:QUEStionable:ENABle

Syntax




```
STATus:QUEStionable:ENABle <value>
```

This command enables the bits in the Questionable Data enable register. The selected bits are then reported to the Status Byte register. The enable register is a mask for enabling specific bits from the Questionable event register to set the questionable summary bit (QUES) of the Status Byte register. This bit (bit 3) is the logical OR of all the Questionable event register bits that are enabled by the Questionable enable register.

```
STATus:QUEStionable:ENABle?
```

This query returns the binary-weighted sum of all bits set in the enable register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- The STATus:PRESet command will clear all bits in the enable register.
- For more information on the Questionable enable register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Questionable Data register are listed in "Questionable Data register" on page 13.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
STAT:QUES:ENAB 16
```

The following query returns the bit enabled in the register.

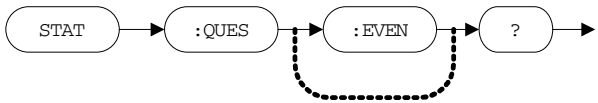
```
STAT:QUES:ENAB?
```

Typical response:

```
+16
```

STATus:QUEStionable[:EVENt]?

Syntax




```
STATus:QUEStionable[:EVENt]?
```

This query returns the binary-weighted sum of all bits set in the Questionable Data event register. This is a read-only register and the bits are cleared when you read the register.

Remarks

- Once a bit is set, it remains set until cleared by reading the event register or the clear status (*CLS) command.
- For more information on the Questionable event register, refer to Chapter 1, "Status system diagram" on page 12. The bit definitions for the Questionable Data register are listed in "Questionable Data register" on page 13.

Example

The following query reads the Questionable event register.

```
STAT:QUES?
```

Typical response:

```
+512
```

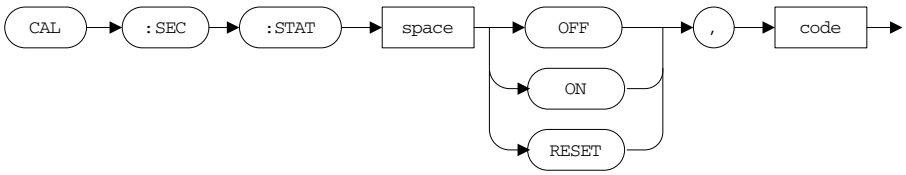
14 CALibration Commands

CALibration:SECure:STATe 130
CALibration:SECure:CODE 131
CALibration:SETup 132
CALibration:VALue 133
CALibration:COUNt? 134
CALibration:STRing 135

This section describes the Calibration commands used to configure the calibration settings for the U2761A. These commands allow you to set the calibration security state, change the security code, set the calibration setup number and calibration value, query the calibration count, and store a calibration message.

CALibration:SECure:STATe

Syntax




```
CALibration:SECure:STATe {OFF|ON|RESET}, <code>
```

This command unsecures or secures the U2761A for calibration. If you forget your security code, you can reset the code by specifying `U2761A`.

```
CALibration:SECure:STATe?
```

This query returns the security state as `0` (OFF) if the U2761A is unsecured, or `1` (ON) if secured.

Parameters

Item	Type	Range of values	Default value
state	Discrete	OFF|ON|RESET	ON
code	Numeric	Up to 12 alphanumeric characters	U2761A

Examples

The following command secures the U2761A for calibration.

```
CAL:SEC:STAT ON, U2761A
```

The following query returns the security state.

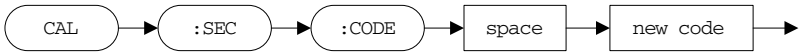
```
CAL:SEC:STAT?
```

Typical response:

```
1
```

CALibration:SECure:CODE

Syntax




```
CALibration:SECure:CODE <new code>
```

This command inputs a new security code. To change the security code, you must first unsecure the U2761A using the old security code, and then enter a new code. The security code is stored in nonvolatile memory.

Parameter

Item	Type	Range of values	Default value
code	String	Up to 12 alphanumeric characters	U2761A

Remark

The first character of the code must always be a letter (A to Z).

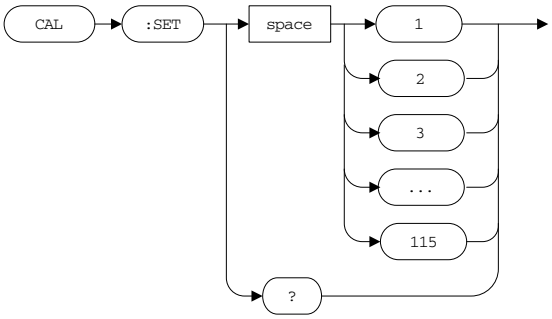
Example

The following command renews the security code of the U2761A.

```
CAL:SEC:CODE U2761A
```

CALibration:SETup

Syntax




```
CALibration:SETup <1|2|3| . . . |115>
```

This command configures the U2761A internal state for each of the calibration steps to be performed. Before any calibration step is performed for the U2761A, the default setup is 0.

```
CALibration:SETup?
```

This query reads the calibration setup number and returns a value from `1` to `115`.

Parameter

Item	Type	Range of values	Default value
setup number	Numeric	1 to 115	0

Examples

The following command sets the U2761A calibration setup number to 5.

```
CAL:SET 5
```

The following query returns the calibration setup number.

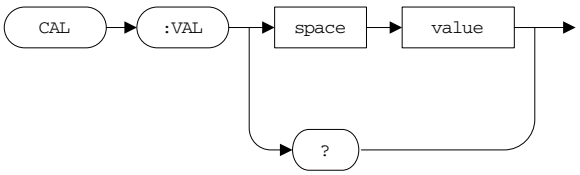
```
CAL:SET?
```

Typical response:

```
+5
```

CALibration:VALue

Syntax




```
CALibration:VALue <value>
```

This command specifies the measured value of the known calibration signal depending on the calibration steps.

```
CALibration:VALue?
```

This query returns the calibration value.

NOTE Refer to the *Agilent U2761A USB Modular Function/Arbitrary Waveform Generator Service Guide* for the range of values of each calibration step.

Examples

The following command sets the value to 1×10^7.

```
CAL:VAL 1E+7
```

The following query returns the calibration value.

```
CAL:VAL?
```

Typical response:

```
+1.0000000000000E+07
```

CALibration:COUNt?

Syntax

```
CALibration:COUNt?
```

This query determines the number of times the U2761A has been calibrated, where the count number is incremented by one for each calibration step. The calibration count is stored in nonvolatile memory.

NOTE Ensure that your U2761A has been calibrated before it leaves the factory. When you receive your U2761A from the factory, be sure to read the count to determine its initial value.

Example

The following query returns the calibration count for the U2761A.

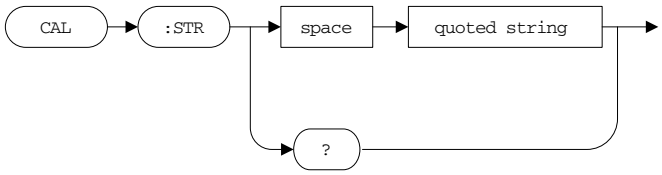
```
CAL:COUN?
```

Typical response:

```
+115
```

CALibration:STRing

Syntax




```
CALibration:STRing <quoted string>
```

This command stores a message in nonvolatile calibration memory. Storing a message will overwrite any message previously stored in memory.

```
CALibration:STRing?
```

This query reads the calibration message and returns a quoted string.

Parameter

Item	Type	Range of values	Default value
string	String	Up to 40 alphanumeric characters	N/A

Examples

The following command stores the calibration message.

```
CAL:STR '01 JAN 2008:CALIBRATED'
```

The following query returns the quoted string.

```
CAL:STR?
```

Typical response:

```
"01 JAN 2008:CALIBRATED"
```

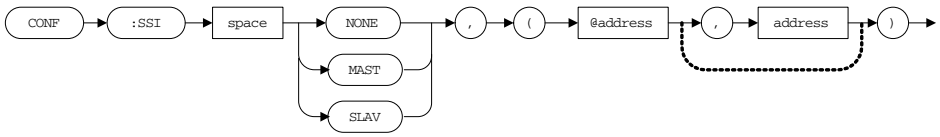
15
CONFigure Command

CONFigure:SSI 138

The `CONFigure:SSI` command handles the synchronization status when the U2761A is used in the U2781A modular instrument chassis.

CONFigure:SSI

Syntax




```
CONFigure:SSI {NONE|MASTer|SLAVe}, (@<address>[,<address>])
```

This command sets the synchronization status (master/slave) when used in the U2781A modular instrument chassis. The master/slave mode forces the U2761A trigger source to Simultaneous Synchronization Interface (SSI). This command is only operational when used in the U2781A chassis.

```
CONFigure:SSI?
```

This query returns the synchronization status as `NONE`, `MAST`, or `SLAV`, and the corresponding address.

Parameters

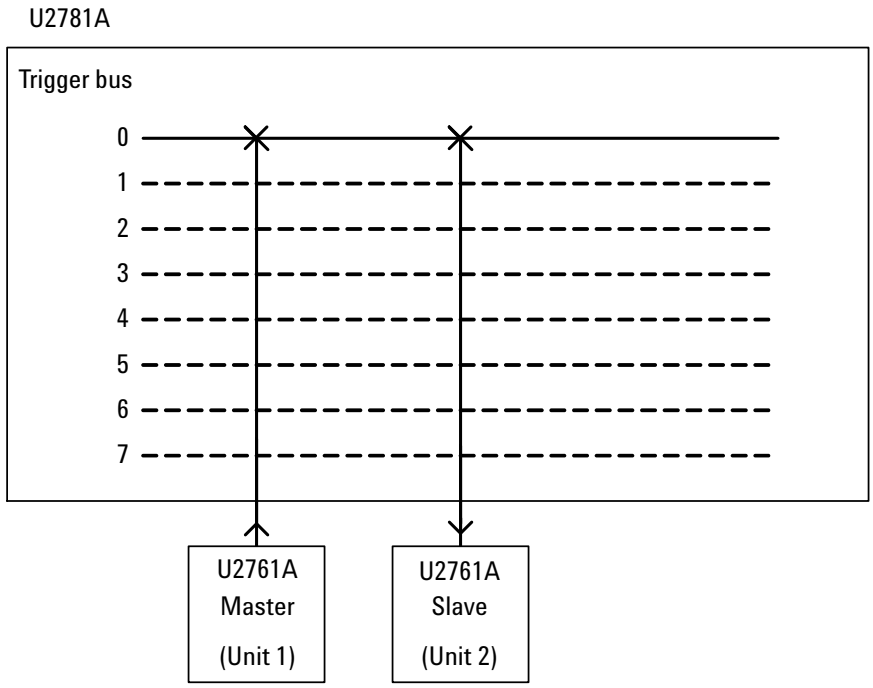
Item	Type	Range of values	Default value
mode	Discrete	NONE|MASTer|SLAVe	NONE
address	Numeric	0 to 7	0

Remarks

- Address is not required to be specified for `CONFigure:SSI NONE`.
- In the master mode, the U2761A sends the SSI signal to the slave unit via the U2781A trigger bus. In the slave mode, the U2761A will receive the signal from the master unit and begin synchronization.
- For more information on the SSI, refer to the *U2781A USB Modular Instrument Chassis User's Guide*.

Examples

The following example sets one U2761A unit to master and one U2761A unit to slave.



For Unit 1: `CONF:SSI MAST, (@0)`

For Unit 2: `CONF:SSI SLAV, (@0)`

The following queries return the status and address.

For Unit 1: `CONF:SSI?`

Typical response:

```
MAST,0
```

For Unit 2: `CONF:SSI?`

Typical response:

```
SLAV,0
```

16 Error Messages

Error Messages 142
- Command errors 142
- Execution errors 144
- Device-dependent errors 151
- Query errors 152
- Instrument errors 152
- Self-test errors 153
- Calibration errors 153
- Arbitrary waveform errors 155

The U2761A SCPI command errors are summarized in this chapter.

Error Messages

Error messages are created once an erroneous condition has been detected.

- Errors are retrieved in first-in-first-out (FIFO) order using the SYSTem:ERRor? command. The first error returned is the first error that was stored. Errors are cleared as you retrieve them.
- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **-350,"Queue overflow"**. No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the U2761A responds with +**0,"No error"**.
- The error queue is also cleared by the clear status (*CLS) command or when power is cycled. The error queue is not cleared by an instrument reset (*RST) command.

Command errors

The following table shows the list of command errors.

Table 16-1 Command errors

Error number	Command errors
–101	**Invalid character** An invalid character was found in the command string. You may have inserted a character such as #, $, or % in a command keyword or within a parameter.
–102	**Syntax error** Invalid syntax was found in the command string. You may have inserted a blank space before or after a colon in the command header, or before a comma.
–103	**Invalid separator** An invalid separator was found in the command string. Check for proper usage of , ; :
–105	**GET not allowed** A Group Execute Trigger (GET) is not allowed within a command string.

Table 16-1 Command errors (continued)

–108	**Parameter not allowed** More parameters were received than were expected for the command. You may have entered an extra parameter or added a parameter to a command that does not require a parameter.
–109	**Missing parameter** Fewer parameters were received than were expected for this command. You have omitted one or more parameters that are required for this command.
–112	**Program mnemonic too long** A command header was received which contained more than the maximum 12 characters allowed. This error is also reported when a character-type parameter is too long.
–113	**Undefined header** A command was received that is not valid. You may have misspelled the command or it may not be a valid command. If you are using the short form of the command, remember that it may contain up to four letters.
–121	**Invalid character in number** An invalid character was found in the number specified for a parameter value
–123	**Exponent too large** A numeric parameter was found where its exponent was larger than 32759
–124	**Too many digits** The mantissa of a numeric parameter contained more than 255 digits, excluding leading zeros
–128	**Numeric data not allowed** A numeric parameter was received but a character string was expected
–131	**Invalid suffix** A suffix was incorrectly specified for a numeric parameter
–134	**Suffix too long** The suffix contains more than 12 characters
–138	**Suffix not allowed** A suffix is not supported for this command
–148	**Character data not allowed** A discrete parameter was received, but a string or numeric parameter was expected
–151	**Invalid string data** An invalid character string was received. Check that the string is enclosed in quotation marks.

Table 16-1 Command errors (continued)

–158	**String data not allowed** A character string was received, but is not allowed for this command
–161	**Invalid block data** The number of data bytes sent does not match the number of bytes specified in the header
–168	**Block data not allowed** Data was sent in the arbitrary block format but is not allowed for this command
–170 to –178	**Expression errors** The U2761A does not accept mathematical expressions

Execution errors

The execution errors are listed in the table below.

Table 16-2 Execution errors

Error number	Execution errors
–211	**Trigger ignored** A Group Execute Trigger (GET) or *TRG was received but the trigger was ignored
–223	**Too much data** An Arbitrary waveform was specified that contains more than 65536 waveform points
–224	**Illegal parameter value** An exact value was expected or an invalid discrete parameter was received
–221	**Settings conflict; frequency reduced for ramp function** When you change to the ramp function (output frequency limit is 200 kHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 200 kHz
–221	**Settings conflict; frequency reduced for pulse function** When you change to the pulse function (output frequency limit is 5 MHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 5 MHz

Table 16-2 Execution errors (continued)

–221	**Settings conflict; frequency reduced for user function** When you change to the arbitrary function (output frequency limit is 200 kHz) from a function that allows a higher frequency, the U2761A will automatically adjust the frequency to 200 kHz
–221	**Settings conflict; frequency forced duty cycle change** If the Square wave function is selected and you change to a frequency that cannot produce the current duty cycle, the duty cycle is automatically adjusted to the maximum value for the new frequency
–221	**Settings conflict; frequency changed due to FM deviation** If the carrier frequency is lower than the minimum FM deviation plus 1 µHz, the carrier frequency will be adjusted to the minimum value allowed
–221	**Settings conflict; amplitude changed due to offset** If the existing output amplitude is not valid, the U2761A will automatically adjust it to the maximum value allowed with the offset voltage specified
–221	**Settings conflict; amplitude changed due to function** The amplitude limits are determined by the currently selected output units when the units are Vrms or dBm due to the differences in crest factor for the various output functions
–221	**Settings conflict; amplitude units change to Vpp due to high-Z load** The output units cannot be set to dBm if the output termination is currently set to “high impedance”
–221	**Settings conflict; offset changed due to amplitude** If the existing offset voltage is not valid, the U2761A will automatically adjust it to the maximum DC voltage allowed with the amplitude specified
–221	**Settings conflict; offset changed due to arbitrary span** If the existing offset voltage is not valid, the U2761A will automatically adjust it to the maximum DC voltage allowed with the arbitrary span on differences in crest factor
–221	**Settings conflict; offset changed on exit from dc function** When you select a different function other than DC, the U2761A will adjust the offset voltage as needed to be compatible with the current amplitude setting
–221	**Settings conflict; low level changed due to high level** If you specify a high level that is less than the existing low level, the U2761A will automatically set the low level to the minimum value allowed lower than the high level
–221	**Settings conflict; high level changed due to low level** If you specify a low level that is greater than the existing high level, the U2761A will automatically set the high level to the minimum value allowed greater than the low level

Table 16-2 Execution errors (continued)

–221	**Settings conflict; pulse width increased due to large period** The U2761A has adjusted the pulse width to the new minimum determined by the current period
–221	**Settings conflict; pulse width decreased due to period** The U2761A has decreased the pulse width to accommodate the specified period
–221	**Settings conflict; FSK hopping frequency changed due to function** The FSK hopping frequency is greater than the maximum frequency of the switched function
–221	**Settings conflict; not able to set amplitude level for dc function** The U2761A is unable to generate an amplitude level for the DC function
–221	**Settings conflict; not able to modulate pulse, modulation is turned off** The U2761A cannot generate a modulated waveform using the pulse function. The selected modulation mode has been turned off.
–221	**Settings conflict; not able to modulate dc, modulation turned off** The U2761A cannot generate a modulated waveform using the DC voltage function. The selected modulation mode has been turned off.
–221	**Settings conflict; not able to sweep pulse, sweep is turned off** The U2761A cannot generate a sweep using the pulse function. The sweep mode has been turned off.
–221	**Settings conflict; not able to sweep dc, sweep turned off** The U2761A cannot generate a sweep using the DC voltage function. The sweep mode has been turned off.
–221	**Settings conflict; AM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; FM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; PM turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; ASK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; FSK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time

Table 16-2 Execution errors (continued)

–221	**Settings conflict; PSK turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; sweep turned off by selection of other mode or modulation** The U2761A will allow only one modulation or sweep mode to be enabled at the same time
–221	**Settings conflict; 10MHz reference connector used by phase output** If you have enabled the output 10 MHz reference signal, the U2761A automatically disables the external phase source. The 10 MHz reference connector cannot be used for both operations at the same time.
–221	**Settings conflict; phase output disabled by phase external** When the external phase source is selected, the output 10 MHz reference signal cannot be enabled. The 10 MHz reference connector cannot be used for both operations at the same time.
–222	**Data out of range; sine frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Sine waveform function
–222	**Data out of range; square frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Square waveform function
–222	**Data out of range; user frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Arbitrary waveform function
–222	**Data out of range; pulse frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Pulse waveform function
–222	**Data out of range; ramp frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary due to the selection of the Ramp waveform function
–222	**Data out of range; frequency; value clipped to lower limit** The waveform frequency has been limited to a lower boundary
–222	**Data out of range; frequency; value clipped to upper limit** The waveform frequency has been limited to an upper boundary
–222	**Data out of range; amplitude; value clipped to lower limit** The waveform amplitude has been limited to a lower boundary

Table 16-2 Execution errors (continued)

–222	**Data out of range; amplitude; value clipped to upper limit** The waveform amplitude has been limited to an upper boundary
–222	**Data out of range; offset; value clipped to lower limit** The offset voltage has been limited to a lower boundary
–222	**Data out of range; offset; value clipped to upper limit** The offset voltage has been limited to an upper boundary
–222	**Data out of range; HIGH value; value clipped to lower limit** The high voltage has been limited to a lower boundary
–222	**Data out of range; HIGH value; value clipped to upper limit** The high voltage has been limited to an upper boundary
–222	**Data out of range; LOW value; value clipped to lower limit** The low voltage has been limited to a lower boundary
–222	**Data out of range; LOW value; value clipped to upper limit** The low voltage has been limited to an upper boundary
–222	**Data out of range; duty cycle; value clipped to lower limit** The Square wave duty cycle is limited to 20% by the U2761A hardware
–222	**Data out of range; duty cycle; value clipped to upper limit** The Square wave duty cycle is limited to 80% by the U2761A hardware
–222	**Data out of range; duty cycle limited by frequency; value clipped to lower limit** The Square wave duty cycle is limited to 40% when the frequency is greater than 10 MHz
–222	**Data out of range; duty cycle limited by frequency; value clipped to upper limit** The Square wave duty cycle is limited to 60% when the frequency is greater than 10 MHz
–222	**Data out of range; ramp symmetry; value clipped to lower limit** The ramp symmetry is limited to a lower boundary of 0.0% by the U2761A hardware
–222	**Data out of range; ramp symmetry; value clipped to upper limit** The ramp symmetry is limited to an upper boundary of 100.0% by the U2761A hardware
–222	**Data out of range; load; value clipped to lower limit** The output load is limited to a lower boundary of 1 Ω by the U2761A hardware

Table 16-2 Execution errors (continued)

–222	**Data out of range; load; value clipped to upper limit** The output load is limited to an upper boundary of 10 kΩ by the U2761A hardware
–222	**Data out of range; pulse period; value clipped to lower limit** The pulse period has been limited to a lower boundary
–222	**Data out of range; pulse period; value clipped to upper limit** The pulse period has been limited to an upper boundary
–222	**Data out of range; pulse width; value clipped to lower limit** The desired pulse width is limited to a lower boundary by the U2761A hardware
–222	**Data out of range; pulse width; value clipped to upper limit** The desired pulse width is limited to an upper boundary by the U2761A hardware
–222	**Data out of range; pulse duty cycle; value clipped to lower limit** The desired pulse duty cycle is limited to a lower boundary by the U2761A hardware
–222	**Data out of range; pulse duty cycle; value clipped to upper limit** The desired pulse duty cycle is limited to an upper boundary by the U2761A hardware
–222	**Data out of range; modulation frequency; value clipped to lower limit** The modulation frequency is limited to a lower boundary by the U2761A hardware
–222	**Data out of range; modulation frequency; value clipped to upper limit** The modulation frequency is limited to an upper boundary by the U2761A hardware
–222	**Data out of range; AM depth; value clipped to lower limit** The AM depth is limited to a lower boundary by the current function amplitude variation
–222	**Data out of range; AM depth; value clipped to upper limit** The AM depth is limited to an upper boundary by the current function amplitude variation
–222	**Data out of range; FM deviation; value clipped to lower limit** The desired FM deviation is limited to a lower boundary by the current function frequency
–222	**Data out of range; FM deviation; value clipped to upper limit** The desired FM deviation is limited to an upper boundary by the current function frequency
–222	**Data out of range; FM deviation limited by minimum frequency** The frequency deviation is limited to the lower limit

Table 16-2 Execution errors (continued)

–222	**Data out of range; FM deviation limited by maximum frequency** The frequency deviation is limited to the upper limit
–222	**Data out of range; PM deviation; value clipped to lower limit** The phase deviation is limited to the lower limit by the current function phase
–222	**Data out of range; PM deviation; value clipped to upper limit** The phase deviation is limited to the upper limit by the current function phase
–222	**Data out of range; shift keying rate; value clipped to lower limit** The shift-keying rate is limited to the lower limit by the current function frequency
–222	**Data out of range; shift keying rate; value clipped to upper limit** The shift-keying rate is limited to the upper limit by the current function frequency
–222	**Data out of range; FSK hopping frequency; value clipped to lower limit** The FSK hopping frequency is limited to the lower limit by the current function frequency
–222	**Data out of range; FSK hopping frequency; value clipped to upper limit** The FSK hopping frequency is limited to the upper limit by the current function frequency
–222	**Data out of range; sweep frequency; value clipped to lower limit** The sweep frequency is limited to the lower limit by the U2761A hardware
–222	**Data out of range; sweep frequency; value clipped to upper limit** The sweep frequency is limited to the upper limit by the U2761A hardware
–222	**Data out of range; sweep time; value clipped to lower limit** The sweep time is limited to the lower limit by the U2761A hardware
–222	**Data out of range; sweep time; value clipped to upper limit** The sweep time is limited to the upper limit by the U2761A hardware
–222	**Data out of range; arbitrary data; value(s) clipped to lower limit** The arbitrary data is limited to the lower limit by the U2761A hardware
–222	**Data out of range; arbitrary data; value(s) clipped to upper limit** The arbitrary data is limited to the upper limit by the U2761A hardware

Table 16-2 Execution errors (continued)

–222	**Data out of range; phase offset; value clipped to lower limit** The phase offset is limited to the lower limit by the U2761A hardware
–222	**Data out of range; phase offset; value clipped to upper limit** The phase offset is limited to the upper limit by the U2761A hardware

Device-dependent errors

The table below contains the device-dependent errors.

Table 16-3 Device-dependent errors

Error number	Device-dependent errors
–310	**System error** The U2761A operation has not completed properly, possibly due to an abnormal hardware or firmware condition
–313	**Calibration memory lost; memory corruption detected** The nonvolatile memory used to store the U2761A calibration constants has detected a checksum error which may be caused by a device failure or extreme conditions such as lightning or strong magnetic fields
–315	**Configuration memory lost; memory corruption detected** The nonvolatile memory used to store the U2761A configuration settings has detected a checksum error which may be caused by a device failure or extreme conditions such as lightning or strong magnetic fields
–350	**Queue overflow** The error queue is full because more than 20 errors have occurred. No additional errors are stored until you remove the errors from the queue.

Query errors

The list of query errors is shown in the following table.

Table 16-4 Query errors

Error number	Query errors
–410	**Query INTERRUPTED** A condition causing an interrupted query error occurred
–420	**Query UNTERMINATED** A condition causing an unterminated query error occurred
–430	**Query DEADLOCKED** A condition causing a deadlocked query error occurred
–440	**Query UNTERMINATED after indefinite response** A query was received in the same program message after a query indicating an indefinite response was executed

Instrument errors

The instrument errors are listed in the following table.

Table 16-5 Instrument errors

Error number	Instrument errors
501 to 502	**501: Cross-isolation UART framing error** **502: Cross-isolation UART overrun error** Indicate an internal hardware failure. The isolation between chassis ground circuits and floating circuits is controlled by an optical isolation barrier and a serial link.
580	**Reference phase-locked loop is unlocked** The phase-lock error status has been enabled and the internal phase-locked loop that controls the frequency is currently unlocked. This error is most likely to occur when the external reference is out of lock range.

Self-test errors

The table below shows the self-test errors.

Table 16-6 Self-test errors

Error number	Self-test errors
604	**Self-test failed; waveform memory bank** Either the waveform RAM or the synthesis IC has failed
605	**Self-test failed; modulation memory bank** The modulation memory bank in the synthesis IC has failed
630	**Self-test failed; internal ADC over-range condition** Indicates a probable ADC failure which could be of the system ADC, ADC input multiplexer, or ADC input buffer amplifier
631	**Self-test failed; internal ADC measurement error** Indicates a probable ADC failure which could be of the system ADC, ADC input multiplexer, or ADC input buffer amplifier

Calibration errors

The calibration errors are listed in the following table.

Table 16-7 Calibration errors

Error number	Calibration errors
702	**Calibration error; calibration memory is secured** A calibration cannot be performed when calibration memory is secured
703	**Calibration error; secure code provided was invalid** Invalid security code specified with the `CAL:SEC:STAT ON` command
706	**Calibration error; provided value is out of range** The calibration value specified with the `CAL:VAL` command is out of range

Table 16-7 Calibration errors (continued)

708	**Calibration error; perform setting is not allowed** The calibration setting was predetermined by calibration setup and modification to the setting is not allowed
755	**Calibration error; timebase calibration is not completed** The timebase calibration steps have not fully completed before exiting calibration mode
756	**Calibration error; DC offset calibration is not completed** The DC offset calibration steps have not fully completed before exiting calibration mode
757	**Calibration error; AC amplitude calibration is not completed** The AC amplitude calibration steps have not fully completed before exiting calibration mode
758	**Calibration error; 0 dB flatness calibration is not completed** The 0 dB flatness calibration steps have not fully completed before exiting calibration mode
759	**Calibration error; –20 dB flatness calibration is not completed** The –20 dB flatness calibration steps have not fully completed before exiting calibration mode
760	**Calibration error; +20 dB flatness calibration is not completed** The +20 dB calibration steps have not fully completed before exiting calibration mode
761	**Calibration error; output impedance calibration is not completed** The output impedance calibration steps have not fully completed before exiting calibration mode
850	**Calibration error; setup is invalid** You have specified an invalid calibration setup number with the `CAL:SET` command
851	**Calibration error; setup is out of order** Certain calibration setups must be performed in a specific sequence in order to be valid
852	**Calibration error; setup timebase calibration is not in sequence** The setup timebase calibration steps are not in sequence as required

Arbitrary waveform errors

The table below shows the Arbitrary waveform errors.

Table 16-8 Arbitrary waveform errors

Error number	Arbitrary waveform errors
770	**Volatile arb waveform memory corruption detected** The volatile memory used to store the Arbitrary waveforms has detected a checksum error. The Arbitrary waveform cannot be retrieved from memory.
800	**Block length must even** The U2761A represents binary data as 16-bit integers, which are sent as two bytes (`DATA:DAC VOLATILE` command)
801	**Block length out of limit** The arbitrary data in binary block was specified which is out of range

17
Factory Default Settings

The factory default settings are listed in this chapter.

The factory default settings in the following table are used when the U2761A is powered on.

Sending the *RST command will reset the U2761A to its factory default state.

Table 17-1 Factory default settings

Features	Factory default settings
Output configuration	
Function	Sine wave
Frequency	1 kHz
Amplitude	1 Vpp
Offset	0 V
Voltage (High/Low)	0.5 V/–0.5 V
Output unit	Vpp
Duty cycle	50%
Symmetry	100%
Output state	Off
Output termination	50 Ω
Pulse	
Period	1 ms
Pulse hold	Pulse width
Pulse width	500 µs
Duty cycle	50%
Modulation	
Carrier waveform (AM, FM, PM)	1 kHz Sine wave
Modulating waveform (AM, FM)	100 Hz Sine wave
Modulating waveform (PM)	10 Hz Sine wave
AM depth	100%

Table 17-1 Factory default settings (continued)

Features	Factory default settings
FM deviation	100 Hz
PM deviation	180 °
Modulation state	Off
Shift keying modulation	
Carrier waveform (ASK, FSK, PSK)	1 kHz Sine wave
Rate (ASK, FSK, PSK)	10 Hz
FSK hop frequency	100 Hz
PSK deviation	180 °
Shift keying state	Off
Frequency sweep	
Start/Stop frequency	100 Hz/1 kHz
Sweep spacing	Linear
Sweep time	1 s
Sweep state	Off
Trigger	
Source	Immediate
Trigger slope	Positive
Output trigger slope	Positive
Output trigger state	Off
Arbitrary	
Binary block byte order format	Normal
Phase-lock	
Source	Internal
Phase offset	0 °
Phase-lock error state	Off

Table 17-1 Factory default settings (continued)

Features	Factory default settings
Phase output state	Off
Calibration	
Calibration security state	On
Calibration security code	U2761A
Calibration setup number	0
Configure	
SSI state	None

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